UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
1201 NE Lloyd Boulevard, Suite 1100
PORTLAND, OR 97232-1274

https://doi.org/10.25923/8h4d-nd66

Refer to NMFS No:
WCRO-2021-00418

May 5, 2021

Christopher Page
Chief, Environmental Resources Branch
Portland District, Corps of Engineers
P.O. Box 2946
Portland, Oregon 97208-2946

Re: Endangered Species Act Section 7(a)(2) Biological Opinion, Letter of Concurrence and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Reinitiation of the U.S. Army Corps of Engineers' Operation and Maintenance Dredging of the Oregon Coastal Navigation Projects

Dear Mr. Page:

Thank you for your letter of May 4, 2021, requesting reinitiation of consultation with NOAA's National Marine Fisheries Service (NMFS) pursuant to section 7 of the Endangered Species Act of 1973 (ESA) (16 U.S.C. 1531 et seq.) for the U.S. Army Corps of Engineers' (Corps) Operation and Maintenance Dredging of the Oregon Coastal Navigation Projects (proposed action). This consultation was conducted in accordance with the 2019 revised regulations that implement section 7 of the ESA (50 CFR 402, 84 FR 45016). In this opinion, we determined that the proposed action is not likely to jeopardize the continued existence of Oregon Coast (OC) and Southern Oregon Northern California Coast (SONCC) coho salmon (*Oncorhynchus kisutch*), southern distinct population segment (DPS) North American green sturgeon (*Acipenser medirostris*) (green sturgeon), and will not result in the destruction or adverse modification of designated critical habitats for OC and SONCC coho salmon or green sturgeon. We also determined that the proposed action is not likely to adversely affect southern DPS Pacific eulachon (*Thaleichthys pacificus*) or their designated critical habitat, eight ESA-listed marine mammal species, four ESA-listed marine turtles, designated critical habitat for the leatherback turtle (*Dermochelys coriacea*), and proposed critical habitat for Southern Resident killer whales (*Orcinus orca*).

As required by section 7 of the ESA, we are providing an incidental take statement (ITS) with the opinion. The ITS describes reasonable and prudent measures we consider necessary or appropriate to minimize the impact of incidental take associated with this action. The ITS sets forth nondiscretionary terms and conditions, including reporting requirements, and the Corps and your applicants must comply with them to implement the reasonable and prudent measures. Incidental take from actions that meet these terms and conditions will be exempt from the ESA's prohibition against the take of listed species. Exceeding the specified level of take in the ITS would trigger reinitiation of this consultation.

Thank you, also, for your request for consultation pursuant to the essential fish habitat (EFH) provisions in Section 305(b) of the Magnuson-Stevens Fishery Conservation and Management Act (16 U.S.C. 1855(b)) for this action. This document includes the results of our analysis of the action's likely effects on EFH pursuant to section 305(b) of the MSA, and includes eight conservation recommendations to avoid, minimize, or otherwise offset potential adverse effects on EFH. Three of these conservation recommendations are a subset of the ESA take statement's terms and conditions. Section 305(b) (4) (B) of the MSA requires Federal agencies to provide a detailed written response to us within 30 days after receiving these recommendations.

If the response is inconsistent with the EFH conservation recommendations, the Corps must explain why the recommendations will not be followed, including the scientific justification for any disagreements over the effects of the action and the recommendations. In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, we established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we request that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

Please contact Jeff Young, fish biologist in the Oregon Coast Branch at 541.315.1571 or jeff.young@noaa.gov if you have any questions concerning this consultation, or if you require additional information.

Sincerely,

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

cc: Chanda Littles, Corps
Bridgette Lohrman, EPA

Endangered Species Act (ESA) Section 7(a)(2) Biological Opinion, Letter of Concurrence, and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the

Reinitiation of the U.S. Army Corps of Engineers' Operation and Maintenance Dredging of the Oregon Coastal Navigation Projects

NMFS Consultation Number: WCRO-2021-00418

Action Agency: U.S. Army Corps of Engineers

Affected Species and NMFS' Determinations:

ESA-Listed Species	Status	Is Action Likely to Adversely Affect Species or Critical Habitat?*	Is Action Likely To Jeopardize the Species?	Is Action Likely To Destroy or Adversely Modify Critical Habitat?
Oregon Coast coho salmon (*Oncorhynchus kisutch*)	Threatened	Yes	No	No
Southern Oregon Northern California Coast coho salmon (*O. kisutch*)	Threatened	Yes	No	No
Southern distinct population segment North American green sturgeon (*Acipenser medirostris*)	Threatened	Yes	No	No
Southern distinct population segment Pacific eulachon (*Thaleichthys Pacificus*)	Threatened	No	N/A	N/A
Southern Resident killer whale (*Orcinus orca*)	Endangered	No	N/A	N/A
Humpback whale (*Megaptera novaengilae*)	Endangered	No	N/A	N/A
Blue whale (*Balaenoptera musculus*)	Endangered	No	N/A	N/A
Fin whale (*Balaenoptera physalus*)	Endangered	No	N/A	N/A
Sei whale (*Balaenoptera borealis*)	Endangered	No	N/A	N/A
Sperm whale (*Physeter catodon*)	Endangered	No	N/A	N/A
Leatherback turtle (*Dermochelys coriacea*)	Endangered	No	N/A	N/A
Green turtle (*Chelonia mydas*)	Threatened	No	N/A	N/A
Northern distinct population segment Loggerhead turtle (*Caretta caretta*)	Endangered	No	N/A	N/A
Olive ridley turtle (*Lepidochelys olivacea*)	Threatened	No	N/A	N/A

Fishery Management Plan That Identifies EFH in the Project Area	Does Action Have an Adverse Effect on EFH?	Are EFH Conservation Recommendations Provided?
Pacific Coast salmon	Yes	Yes
Pacific Coast groundfish	Yes	Yes
Coastal pelagic species	Yes	Yes

Consultation Conducted By: National Marine Fisheries Service, West Coast Region

Issued By:

Kim W. Kratz, Ph.D
Assistant Regional Administrator
Oregon Washington Coastal Office

Date: May 5, 2021

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1. INTRODUCTION

This Introduction section provides information relevant to the other sections of this document and is incorporated by reference into Sections 2 and 3, below.

1.1. Background

The National Marine Fisheries Service (NMFS) prepared the biological opinion (opinion) and incidental take statement (ITS) portions of this document in accordance with section 7(b) of the Endangered Species Act (ESA) of 1973 (16 U.S.C. 1531 et seq.), and implementing regulations at 50 CFR 402, as amended.

We also completed an essential fish habitat (EFH) consultation on the proposed action, in accordance with section 305(b)(2) of the Magnuson-Stevens Fishery Conservation and Management Act (MSA) (16 U.S.C. 1801 et seq.) and implementing regulations at 50 CFR 600.

Because the proposed action would modify a stream or other body of water, NMFS also provides recommendations and comments for the purpose of conserving fish and wildlife resources, and enabling the Federal agency to give equal consideration with other project purposes, as required under the Fish and Wildlife Coordination Act (16 U.S.C. 661 et seq.).

We completed pre-dissemination review of this document using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (DQA) (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. A complete record of this consultation is on file at the Oregon Coast Branch in Roseburg, Oregon.

On January 24, 2020, we received a request from the Corps to dredge a large gravel shoal (300,000 cubic yards [cy]) that is threatening to impede access to the Gold Beach boat basin and access channel. The Corps proposed to dispose of the dredged material at an upland disposal site adjacent to the boat basin. On January 29, 2020, we provided to the Corps our verification that this proposed project was consistent with the project design criteria of the SLOPES in-water/over-water structures opinion (NMFS No.: NWR-2011-5585).

In February 2021, we were contacted by the Corps regarding the need for the Corps to increase the amount of dredged material removed from the federally authorized Rogue River navigation channel at the entrance channel and the Gold Beach boat basin access channel. At this time, we learned the Corps had not dredged the large gravel shoal and the disposal of this dredged material could no longer be placed at an upland site and would be placed at an authorized Rogue River ocean dredged material disposal site (ODMDS). After discussions with the Corps, we determined that the increased amount of material at the Rogue River entrance and boat basin access channel would exceed the amount and extent of the take at the Rogue River project provided in their current biological opinion (NMFS No.:WCR-2016-5055), issued in May 2017. Thus, on March 4, 2021, the Corps reinitiated consultation on Operation and Maintenance

Dredging of the Oregon Coastal Navigation Projects. Several post initiation phone calls and emails helped clarify the action.

1.2. Consultation History

The Corps previously consulted with NMFS on these activities and received a biological opinion dated May 28, 2010 (NMFS No.: NWR-2009-1756). The 2010 biological opinion addressed effects to OC and SONCC coho salmon (*Oncorhynchus kisutch*) coho salmon, southern distinct population segment (DPS) of North American green sturgeon (*Acipenser medirostris*) (green sturgeon), southern DPS Pacific eulachon (*Thaleichthys pacificus*) (eulachon), six species of marine mammals, four species of marine turtles, and their designated and proposed critical habitats. This opinion included consultation on EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagics species.

After issuance of the 2010 biological opinion, we designated critical habitat for Pacific eulachon (76 FR 65324) and leatherback sea turtle (77 FR 4170). In addition, the Corps identified project modifications that would result in take and adverse effects that were not considered in the 2010 biological opinion or EFH consultation. Modifications to the proposed action included increased amounts of dredged materials removed from the Rogue River entrance and boat basin access channels for 2017 and annually, thereafter. Thus, The Corps reinitiated consultation in 2016 and we issued a biological opinion and EFH consultation on May 10, 2017 (WCR-2016-5055). The opinion addressed effects to OC and SONCC coho salmon, green sturgeon, eulachon, eight ESA-listed marine mammals, four species of marine turtles, and all species' designated critical habitats. The 2017 biological opinion also addressed affects to EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

On March 4, 2021, we received a letter from the Corps requesting reinitiation of the Corps' Operation and Maintenance Dredging of the Oregon Coastal Navigation Projects. With the letter, the Corps included a biological assessment (BA) describing the modified proposed action and the Corps' effects determinations for ESA-listed species and critical habitats. The proposed action modifications included an increased annual amount of dredged material in the Rogue River and a one-time only removal and disposal of 200,000 cy from the large gravel shoal during the 2021 dredging season. Additionally, the proposed action modifications included the addition of work area isolation, dewatering, and fish salvage at the Depoe Bay sediment check dam. In their BA, the Corps determined that the proposed action was likely to adversely affect OC coho salmon, SONCC coho salmon, and southern DPS green sturgeon and designated critical habitat for these species. The Corps also determined that their proposed action was not likely to adversely affect southern DPS eulachon, seven species of marine mammals, four species of marine turtles, or designated critical habitat for eulachon and leatherback sea turtles or proposed critical habitat for Southern Resident killer whales (Table 1).

Table 1. Federal Register notices for final rules that list threatened and endangered species, designate critical habitats, or apply protective regulations to listed species considered in this consultation. Listing status: “T” means listed as threatened and “E” means listed as endangered under the ESA.

Species	Listing Status	Critical Habitat	Protective Regulations
Marine and Anadromous Fish			
Coho salmon (*Oncorhynchus kisutch*)			
Oregon Coast	T 6/20/11; 76 FR 35755	2/11/08; 73 FR 7816	2/11/08; 73 FR 7816
Southern Oregon Northern California Coasts	T 6/28/05; 70 FR 37160	5/5/99: 64 FR 24049	6/28/05; 70 FR 37160
North American green sturgeon (*Acipenser medirostris*)			
Southern DPS	T 4/07/06; 71 FR 17757	10/09/09; 74 FR 52300	6/02/10; 75 FR 30714
Pacific eulachon (*Thaleichthys pacificus*)			
Southern DPS	T 3/18/10; 75 FR 13012	10/20/11; 76 FR 65324	Not applicable
Marine Mammals			
Blue whale (*Balaenoptera musculus*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Fin whale (*Balaenoptera physalus*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Humpback whale (*Megaptera novaengliae*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Mexico DPS	T 9/8/16; 81 FR 62260	5/21/21; 86 FR 21082	ESA section 9 applies
Central America DPS	E 9/8/16; 81 FR 62260	5/21/21; 86 FR 21082	ESA section 9 applies
Sei whale (*Balaenoptera borealis*)	E 12/02/70; 35 FR 18319	Not applicable	ESA section 9 applies
Sperm whale (*Physeter macrocephalus*)	E 12/02/1970	Not applicable	ESA section 9 applies
Killer Whale (*Orcinus orca*)			
Southern Resident DPS	E 11/18/05; 70 FR 69903	9/19/19; 84 FR 49214*	ESA section 9 applies
Marine Turtles			
Green turtle (*Chelonia mydas*)	ET 7/28/78 43 FR 32800	9/02/98; 63 FR 46693	ESA section 9 applies
Leatherback turtle (*Dermochelys coriacea*)	E 6/02/70 ; 39 FR 19320	1/26/12; 77 FR 4170	ESA section 9 applies
Loggerhead turtle (*Caretta caretta*)	T 7/28/78; 43 FR 32800	Not applicable	07/28/1978; 32800
Olive Ridley turtle (*Lepidochelys olivacae*)	ET 7/28/78 43 FR 32800	Not applicable	ESA section 9 applies

*On September 19, 2019, we proposed to revise critical habitat designation for Southern Resident killer whales under the ESA by designating six new areas along the West Coast. Specific new areas proposed along the U.S. West Coast include 15,626.6 square miles (mi^2) (40,472.7 square kilometers (km^2)) of marine waters between the 6.1-meter (m) (20 feet (ft)) depth contour and the 200-m (656.2 ft) depth contour from the U.S. international border with Canada south to Point Sur, California.

The Corps also determined that the proposed action would adversely affect EFH for Pacific Coast salmon (PFMC 2014), Pacific Coast groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998).

This consultation is based on the Corps’ BA and email and phone communication from the Corps received on March 2, March 8, March 10, 2021, and April 6 and 7, 2021.

1.3. Proposed Federal Action

Under the ESA, “action” means all activities or programs of any kind authorized, funded, or carried out, in whole or in part, by Federal agencies (50 CFR 402.02).

1.3.1 Dredging

The Corps dredges under authority of section 10 of the Rivers and Harbors Act, and 404 of the Clean Water Act, to maintain their federally-authorized navigation channels and proposes to conduct annual maintenance dredging in authorized navigation projects at 10 locations along the Oregon coast (coastal projects). Table 3, below, summarizes the proposed schedule of dredging activities at each of the coastal projects (all depths are measured from the mean lower low water (MLLW) surface elevation in this document, unless otherwise specified). Scheduling of dredging at the coastal projects depends on ocean and channel conditions, funding, commercial and seasonal demand, dredge crew safety, equipment mobilization costs, and in-water work periods that minimize impacts to aquatic species. The Corps does not dredge every area identified in Table 3 annually. To the extent possible, the Corps dredges the entrance channels first (when ocean conditions permit) and dredging upriver occurs later in the season. Dredging does not typically occur over the entire footprint of the entrance or navigational channels equally. Within these channels, dredging occurs at those specific locations where shoals have developed since the previous dredging effort. In the case of the turning areas and boat basin access channels, these areas are still variable, but the Corps may dredge these more equally due to the time between dredging events.

Weather and ocean conditions often limit most dredging to the period between April 1 and October 31, though it is possible in some years, and in some areas, to dredge outside of these dates. Sometimes projects need to be dredged early in the season, with follow-up dredging to remedy accumulation areas and ensure adequate navigational depth and width in August or September. Such practices also depend on available funding and the amount of shoaling material to remove. At many sites, if early season dredging is not conducted the entrance channel will shoal, making maintenance dredging later in the year difficult or impossible. Dredging in the spring and first part of the summer on some of the coastal projects makes the entrance channels safer to cross for the U.S. Coast Guard (USCG) and other users since shoaling makes the entrances rougher even in light sea conditions. When conducted, most dredging will occur for 24 hours per day, depending on weather, staffing, and other factors.

The bulk of maintenance dredging at the coastal entrances is done with the Corps' dredge Yaquina, although the dredge Essayons typically dredges the entrance to Coos Bay, and contractor hydraulic cutterhead (also called cutterhead pipeline dredging) or mechanical dredges may be used as needed, particularly for the boat basin access channels and the Depot Slough portion of the Yaquina Bay and River Project. These dredging techniques are described in more detail below.

Hopper dredging

Hopper dredges (Figure 1) are typically self-propelled vessels that use hydraulic suction drag arms to load sediment as a slurry (approximately 20% solids) into an internal hopper. The Yaquina and Essayons, which the Corps uses on the coastal projects, are trailing suction dredges, which lower one or two drag arms to the seabed floor to perform material suction. Once loaded, the dredge retracts the drag arms on deck and transits to the placement site.

During dredging operations, the Corps allows water to overflow the hopper via weirs, resulting in a load that is 60 to 70% solids. The overflow is designed to reduce sediment discharge into the water column. Water is skimmed from the top 2 inches of the hopper, which is the area that has the lowest turbidity. The amount of turbidity depends on the type of material dredged and percentage of fine sediment in the dredged material (Table 2).

Table 2. Summary of maintenance dredging at the Corps' Oregon coastal projects.

Project	Location	Authorized Depth (ft.)	Dredged Area (acres)	Dredged Material Volume (cy)	Load Volume	Anticipated Loads	Maximum Dredging Days	Dredge Frequency	Proposed dredge period	Sediment Characteristics	Turbidimeter test Required	Sediment Placement Location
Tillamook Bay	Garibaldi Access Channel	12+2+3	2.75	50,000	NA	NA	45	5 to 8 yrs	15 Jul to 15 Mar	48% sand	Yes	Flow-lane; Upland
Depoe Bay	Boat Basin	8+2+3	6.7	25,000	NA	NA	30	5 to 8 yrs	1 Jul to 15 Mar	60% sand	Yes	Intertidal (surf zone)
	Sediment Check Dam	0+1+3	0.24	2,000	NA	NA	7	5 to 8 yrs	1 Jul to 15 Mar	65% sand	Yes	Intertidal (surf zone)
Yaquina Bay	Entrance Channel	40+5+3 RM -1 to 0 30+2+3 RM 0 to 2+20 18+2+3 RM 2+20 to 4+20	217.5	450,000	800	563	46	Annually	15 Jun to 31 Oct (6 days in Apr or May)	94% sand	No	ODMDS
	South Beach Marina Access Channel	10+2+3	4.6	25,000	800	31	30	5 to 8 yrs	1 Jul to 31 Oct	45% sand	Yes	ODMDS
	Yaquina R. (Depot Slough)	10+2+3	8.3	100,000	800	125	30	5 to 8 yrs	1 Jul to 31 Oct	95% silt	Yes	ODMDS
Siuslaw River	Entrance and Nav. Channel	18+5+3 RM -1 to 0.2 16+2+3 RM 0.2 to 5	16	100,000	800	125	20	Annually	1 Jun to 31 Oct	97% Sand	No	ODMDS

Project	Location	Authorized Depth (ft.)	Dredged Area (acres)	Dredged Material Volume (cy)	Load Volume	Anticipated Loads	Maximum Dredging Days	Dredge Frequency	Proposed dredge period	Sediment Characteristics	Turbidimeter test Required	Sediment Placement Location
	Turning Basin	18+5+3	5.5	100,000	800	125	20	5 to 8 yrs	1 Jun to 31 Oct		No	ODMDS
Umpqua River	Entrance and Nav. Channel	26+5+3 RM -1 to 0-10 22+2+3 RM 0-10 to 11+40	40 288.5	250,000	800	313	20	Annually	1 Jul to 31 Oct (4 days in Apr or May)	97% sand	No	ODMDS/In-bay
	Boat Basin Access Channels	12/16+2+3	20.2	25,000	800	31	30	Annually	1 Jul to 31 Oct	20 % sandy silt	Yes	ODMDS/In-bay
Coos Bay	Entrance Channel	47+5+3 RM -1 to 1	60.6	1,000,000	800	223	20	Annually	15 Jun to 31 Oct (5 days in Apr or May)	99% sand	No	ODMDS/In-bay
	Nav. Channel RM 1 to 12	37+3+3 RM 1 to 12	570	300,000	800	375	35	Annually	1 Jul to 31 Oct	94% sand	No	ODMDS/In-bay
	Nav. Channel RM 12 to 15	37+3+3 Rm 12 to 15		1,000,000	800	1,250	100	Annually	1 Jul to 31 Oct	30% sand	Yes	ODMDS/In-bay
	Charleston Access Channel	17/16+2+3	22	50,000	800	63	30	Annually	1 Jul to 30 Nov (up to 9 days in Apr or May)	98% sand	No	ODMDS/In-bay
Coquille River	Entrance Channel	13+4+3	51.5	38,000	600	63	7	Annually	15 Jun to 31 Oct	84% sand	No	ODMDS

Project	Location	Authorized Depth (ft.)	Dredged Area (acres)	Dredged Material Volume (cy)	Load Volume	Anticipated Loads	Maximum Dredging Days	Dredge Frequency	Proposed dredge period	Sediment Characteristics	Turbidimeter test Required	Sediment Placement Location
	Boat Basin Access Channel	13+2+3	22.3	9,000	600	15	14	5 to 10 yrs	1 Jul to 31 Oct	20% sand	Yes	ODMDS/Flow-lane
Port Orford	Nav. Channel	16+4+3	1.55	45,000	NA	NA	50	Annually	1 May to 31 Oct	95 % sand	No	Breakwater/Nearshore
	Dock Face	16+4+3	0.21	7,000	NA	NA	30	Annually	1 May to 15 Apr		No	Breakwater/Nearshore
Rogue River	Entrance Channel	13+4+3	40	130,000	400	325	65	Annually	1 Jun to 31 Oct	Gravel/sand, fines <1%	No	ODMDS
	Boat Basin Access Channel	10+2+3	5.3	75,000	400	188	50	Annually	15 Jul to 31 Oct	71% silty sand	Yes	ODMDS/Intertidal (surf zone)
	AMD Gravel Bar	NA	16	200,000	400	500	150	**2021 Only**	15 June to 31 Oct	100% Coarse-grained materials	No	ODMDS
Chetco River	Entrance Channel	14+4+3	13.8	70,000	450	156	12	Annually	1 Jun to 31 Oct	49% sand, varies widely by location	No	ODMDS/Nearshore
	Boat Basin Access Channel and Turning Basin	12+2+3 14+2+3	4.1	9,000	450	20	14	5 yrs	15 Jul to 31 Oct		Yes	ODMDS/Nearshore

Red text represents the changes to the proposed action from the 2017 biological opinion (WCR-2016-5055)

Figure 1. Typical hopper dredge schematic (left) and the *Yaquina* hopper dredge (right).

Hydraulic cutterhead dredging

Hydraulic cutterhead dredges use hydraulic slurry, similar to hopper dredges as generally 80% water and 20% solids, to transport material through a pipeline to the designated placement site. The hydraulic cutterhead dredge (also often called a cutterhead pipeline dredge), is the most common and versatile of the hydraulic dredges, which has a rotating cutter on the end of the ladder used to dislodge consolidated material to improve dredge performance (Figure 2). A series of dredge pumps move the slurry from the cutterhead through a pipe and to the final placement site. The barge could be self-propelled, or moved around by a small powered boat or by using winches and anchors.

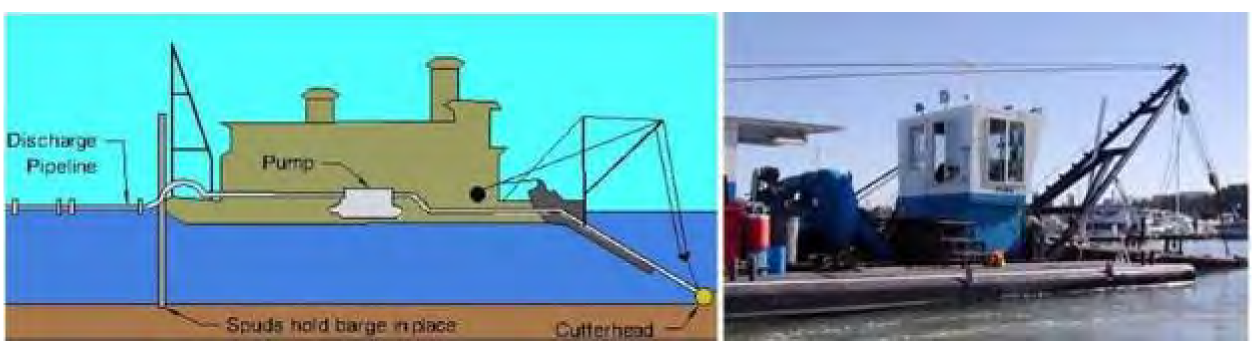

Figure 2. Typical hydraulic cutterhead dredge schematic (left) and small hydraulic cutterhead dredge (right).

Mechanical dredging

Mechanical dredging involves a barge mounted digging machine that uses a bucket to excavate material, which then goes into scows or barges for transport to an in-water or upland disposal location. The most common mechanical dredge arrangement includes a barge-mounted crane with a clamshell bucket (commonly referred to as a clamshell dredge, Figure 3). Another common type includes an excavator mounted on a shallow draft barge. The Corps uses mechanical dredges for maintenance dredging in areas where other forms of dredging may not be effective (e.g., under bridges and in other tight areas, like berthing areas). Typically, the mechanical dredge will use a bucket to place sediment on a barge for disposal in a nearshore area or ocean dredged material disposal site (ODMDS).

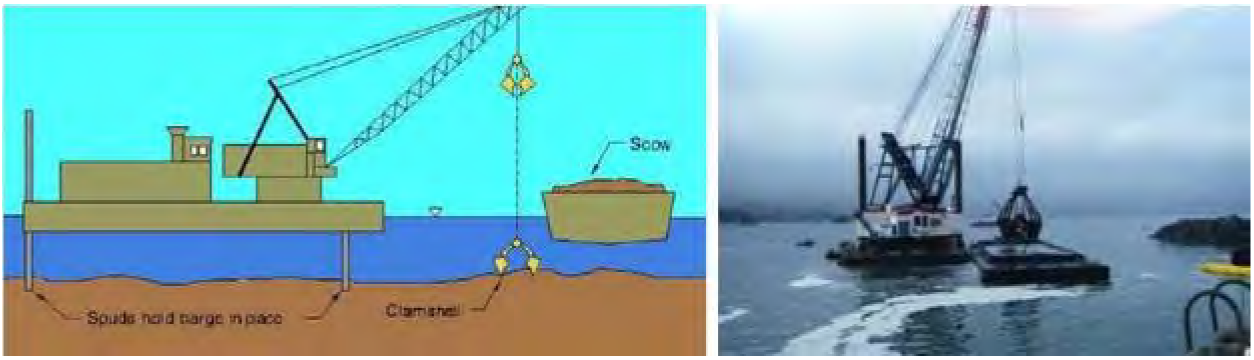

Figure 3. Typical clamshell dredge schematic (left) and photograph (right).[1]

Dredging Prism

Congress authorizes federal navigation channels by specific depth and width. These authorized channel dimensions are generally based on maximizing net transportation savings considering the characteristics of the vessels using the channel and include consideration of safety, physical conditions, and vessel operating characteristics. Efforts to deepen or widen the existing authorized navigation channels would constitute a change to the Federal project that the Corps would pursue outside of their Operations and Maintenance program for the Oregon Coastal projects. This consultation does not provide ESA coverage for deepening or widening the currently authorized navigation channels at the Oregon Coastal projects.

The dredging environment is dynamic and varies with the physical conditions (tides, currents, flow velocity, and waves); the dredged material conditions (silt, clay, sand, gravel, rock, etc.); the channel design (depths being dredged, side slopes, etc.); and the type of dredging equipment (mechanical, hydraulic, hopper, etc.). Due to these variables, the Corps recognizes that dredging beyond the authorized project dimensions will occur. This is necessary to assure that Federal project depth and width are maintained between dredging events. Three phases of dredging occur at the coastal projects including project maintenance, advance maintenance, and allowable overdepth.

Project maintenance. Project maintenance is dredging that occurs down to the federally authorized project dimensions. These federally authorized channel widths and depths are described in detail for each of the coastal projects in the individual descriptions for each site

[1] Source: Port of Port Orford 2012.

(Section 2.6). For example, the Rogue River entrance channel is authorized to -13 feet MLLW. Minus 13 feet would be the project maintenance depth.

Advance maintenance. Advance maintenance dredging (depth and/or width) is dredging beyond the federally authorized project dimensions, but included in the advance maintenance prism. Advance maintenance allows for dredging in a dynamic environment to ensure project dimensions will be maintained for channel users until the next dredging event occurs. Because most of the coastal projects are dredged only once a year, advanced maintenance dredging is crucial to maintaining navigation safety. Again, using the Rogue River as an example, the entrance channel is authorized to -13 feet MLLW (project depth). Advance maintenance dredging provides for an additional 4 feet. Depending on conditions, -17 feet MLLW would normally be an acceptable depth in the advance maintenance prism.

Allowable overdepth. Allowable overdepth is the dredging area outside of the advance maintenance prism. To illustrate, when a cutterhead dredge is digging to the maximum advance maintenance depth, there will be a disturbance and potential removal of material in the allowable overdepth area. The cutterhead must reach into the allowable overdepth area in order to remove material down to the maximum advance maintenance depth. Allowable overdepth compensates for the dredging process. Providing an allowable overdepth prism allows the Corps to remove the maximum amount of advance maintenance material when needed. Allowable overdepth for the coastal projects extends three feet below the advance maintenance prism. For example, allowable overdepth for the Rogue River Project is considered between -17 feet MLLW (limit of advance maintenance dredging) and -20 feet MLLW. Therefore, -20 feet MLLW is considered the maximum allowable overdepth at the Rogue River Project.

Channel/river management

During proposed dredging and placement operations, the hopper dredge operates at low speed (about one knot) and uses two radio stations to communicate with the USCG, pilots and local vessels. Vessel transit between removal and placement sites is approximately eight knots when loaded and ten knots empty. Towed barges are slightly slower. Corps personnel also conduct visual water quality monitoring from the dredge.

1.3.2 Dredged Material Disposal

Disposal sites vary by project and include 1) upland, 2) in-water, 3) surf zone, and 4) ODMDS. Disposal practices are discussed for each project in the Coastal projects activities section of this document.

Upland

Projects may have a sponsor-provided upland disposal site. Projects that previously included an upland disposal option will retain such disposal option. The description of the proposed action does not describe these upland sites because the specific sites are uncertain, and are usually selected by sponsor or contractor just prior to the dredging action.

Upland disposal may occur when hopper or hydraulic cutterhead dredging operations that use a pipeline to transport dredged materials to the upland disposal site. Upland disposal sites normally have dikes to contain the dredged material and water. The return water is held in settling ponds controlled by weirs to reduce suspended sediment levels and meet state water quality standards. Any future proposed upland placement from dredging will require the local project sponsor (i.e. the local Ports) to be responsible for obtaining all environmental clearances, permits, and approvals for that site prior to its use. The Corps will not dispose of dredged sediments at any upland location without the sponsor port demonstrating that they are adhering to all relevant environmental regulatory requirements, including compliance with Clean Water Act (CWA), Coastal Zone Management Act (CZMA), ESA, or any other regulatory requirement. In most cases, a separate CWA section 404 permit will be necessary, triggering applicable environmental regulatory compliance requirements.

ODMDS

The Environmental Protection Agency (EPA) designated ODMDS sites offshore of the Yaquina River (2012), Siuslaw River (2010), Umpqua River (2009), Coos Bay (1986 [Sites H and E] and 2006 [Site F]), Coquille River (1990), Rogue River (2009), and Chetco River (1991) under section 102(c) of the Marine Protection, Research and Sanctuaries Act (MPRSA), 33 U.S.C. §§ 1401 to 1445. The ocean disposal sites are between one and three miles offshore in waters -45 to -205 feet deep, as measured from MLLW. The Corps will meet the requirements of the EPA designated ODMDS sites.

In-water

Dredged material is also placed at in-water sites that are in-bay/river locations adjacent to the navigation channel (Coos Bay), in the flow-lane (Tillamook and Coquille), and near-shore (Port Orford breakwater and near-shore placement sites, and Chetco).

Surf zone

Material is placed on the beach, within the surf zone at Rogue and directly on rocks at Depoe Bay.

The type of material to be dredged dictates the acceptable and feasible disposal practice, in order to will reduce turbidity in the receiving waters. In-water disposal may occur in the ocean or occasionally at flow-lane disposal sites in deep areas in and adjacent to the channel. Typically, hopper dredges dispose of dredged material in the ocean or flow-lane site, as may a barge or scow from a mechanical dredging operation. Discharge from a hopper dredge or barge or scow occurs as the vessel is moving and its doors are opened and the material is discharged. In hopper dredges, the rate of discharge can be varied to some extent by how far the doors are opened. Hydraulic cutterhead dredges may also dispose of dredged materials in-water, however the location of the discharge from the pipeline will vary depending on the project and could be at or below the surface of the water.

1.3.3 Sediment Sampling and Analysis

The Corps routinely evaluates sediment from the coastal projects, on a five-year cycle. At some projects (e.g. Tillamook Bay), sediment sampling and analysis is done on an as-needed based. The results of these studies (Table 3) indicate that sediments, especially in the Entrance Channel areas, are predominately sand and gravel-sized material with minimal amounts of fine sediment or volatile solids (with some exceptions). The sediment tends to be finer-grained, although still predominately sand, in areas outside of the main Navigation Channels, such as in the Boat Basin Access Channels.

The Corps follows the procedures in the Sediment Evaluation Framework (SEF) for the Pacific Northwest (RSET 2016) for assessing, characterizing, and managing (disposing) sediments and determining suitability for unconfined in-water placement. Prior to the finalizing SEF in 2009, the Corps evaluated sediment and determined suitability for unconfined in-water placement based on the guidance of Ocean Dumping Testing Manual (1991), the Inland Testing Manual (1998), and the Dredged Material Evaluation Framework (DMEF) (1998). As projects come up for sediment sampling, the sampling plan is reviewed by the interagency Portland Sediment Evaluation Team (PSET) to ensure that sampling results are consistent with SEF guidelines and requirements for unconfined in-water placement.

The Corps' sampled and analyzed sediments results indicate a history of low concentrations of contaminant of concern and these projects currently meet the Management Area Ranking Definition of "Low" (RSET 2016). Given this history, the Corps anticipates that dredged sediments at the Coastal Projects will continue to meet the SEF requirements to be suitable for unconfined in-water placement.

Table 3. Summary of sediment analysis results for Corps' Oregon Coastal Projects.

Sampling location	Most recent sampling*	Sediment Composition	Analyzed samples	Evaluation	Samples above screening levels
Tillamook Bay	08/22/2007 (09/2014)	48% sand, 50% fines, 1.7% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Depoe Bay boat basin	07/27/2010 (07/2015)	60% sand, 40% fines, <1% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Depoe Bay behind check dam	07/27/2010 (07/2015)	65% sand, 32% fines, 3% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Yaquina River main channel	07/28/2010 (07/2015)	94% sand, 6% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Yaquina River South Beach	07/28/2010 (07/2015)	45% sand, 55% fines, <1% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons, TPH	SEF	None; material suitable for unconfined in-water placement
Siuslaw entrance/nav. channel	09/01/2011	97% sand, 3% fines, 0% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons, TPH	SEF	None; material suitable for unconfined in-water placement
Siuslaw turning basin	09/01/2011	97% sand, 3% fines, 0% gravel	Physical	SEF	None; material suitable for unconfined in-water placement
Umpqua (main channel, Winchester Bay, Gardiner channel)	08/31/2011	FNC: 97.2% sand, 2.6% fines WB: 19.8% sand; 79.3% fines Gardiner: 89.6% sand, 10.4% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Coos Bay (main channel)	09/16/2009 (07/2014)	86% sand, 14% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides, chlorinated hydrocarbons, TPH	SEF	None; material suitable for unconfined in-water placement
Coos Bay (Charleston channel)	09/16/2009 (07/2014)	99% sand, 1% fines	Physical	SEF	None; material suitable for unconfined in-water placement
Coos Bay (Isthmus Slough)	09/16/2009 (07/2014)	10% sand, 90% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides, chlorinated hydrocarbons, TPH	SEF	None; material suitable for unconfined in-water placement
Coquille River (main channel)	08/30/2011	84% sand, 2% fines, 14% gravel	Physical	SEF	None; material suitable for unconfined in-water placement
	04/25/2014	Visual observations of fine and coarse sands, gravel, and shell hash	Dioxins and furans	SEF	None; material suitable for unconfined in-water placement
Coquille River (boat basin access channel)	08/30/2011	20% sand, 80% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides	SEF	None; material suitable for unconfined in-water placement

Table 3. Summary of sediment analysis results for Corps' Oregon Coastal Projects.

Sampling location	Most recent sampling*	Sediment Composition	Analyzed samples	Evaluation	Samples above screening levels
	04/25/2014	Visual observation of fine sand, silt, clay	Dioxins and furans	SEF	None; material suitable for unconfined in-water placement
Port Orford turning basin	08/06/2007 (07/2014)	95% sand, 5% fines, 1% gravel	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons	SEF	None; material suitable for unconfined in-water placement
Rogue River (Federal navigation channel)	09/18/2012	45% gravel, 53% sand, <1% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin	SEF	None; material suitable for unconfined in-water placement
Rogue River (boat basin access channel) – outer channel	09/18/2012	Outer (RR-PG-02) contained 82.5% gravel, 11.3% sand, and 0.74% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides	SEF	Outside breakwater: None; material suitable for unconfined in-water placement
	05/04/2015	Visual observation of gravels, cobbles, and sands	Grain size delineation	SEF	None; material suitable for unconfined in-water placement
Rogue River (boat basin access channel) – Inner Channel	9/18/2012	Inner (RR-PG-03 and RR-PG-04) averaged 9.32% gravel, 52.8% sand, and 39.2% fines	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides	SEF	Inside breakwater: Phenol at 1,800ug/kg; won't be dredged without further characterization
	07/21/2014	1% gravel, 50% sand, 49% fines	Grain size, ammonia, sulfides, TOC, metals, PCB, phenols, phthalates, misc. extractables, PAH, pesticides, chlorinated hydrocarbons, TPH, marine bioassays	SEF	Phenol at 640 ug/kg, 4-methyphenol at 1,500 ug/kg, multiple one-hit bioassay failures; fine grained materials in the inner portion of access are **unsuitable** for unconfined in-water placement
	05/04/2015	Visual observation of small gravels, sands, and fines/muck	Grain size delineation	SEF	Fine-grained materials in the inner portion of access channel are **unsuitable** for unconfined in-water placement
Rogue River AMD Gravel Bar	2/04/2020	Visual observation of gravel and cobble in the shoal	No testing required	SEF	None, coarse-grained material suitable for unconfined in-water sediment placement
Chetco River (Federal channel and boat basin entrance)	06/09/2011	49% sand, 6% silt/clay, 45% gravel (varied widely by location)	Metals, TOC, PCB, phenols, phthalates, misc. extractables, PAH, organotin, pesticides, TPH	SEF	2, 4-dimethylphenol MRL slightly above screening level (sample result was ND); suitable for unconfined in-water placement

1.3.4 Conservation Measures

The Corps proposed the following conservation measures for all maintenance dredging and dredged material placement:

1. Dredging in the project area will continue to occur in the identified period each year (Table 1), avoiding key migration periods for a number of protected fish species when possible. Dredging in shallow water areas (less than -20 feet MLLW) will be performed to the extent possible at times that will avoid the peak outmigration periods for ESA-listed salmon.
2. Maintenance dredging and placement will continue in areas that are dredged or used for placement on a regular basis and generally have a lower biological productivity than other areas.
3. To minimize water turbidity and the potential for entrainment of organisms, the draghead of the hopper dredge or the cutterhead of the hydraulic cutterhead dredge will remain on the bottom to the greatest extent possible and only be raised 3 feet off the bottom when necessary.
4. If the captain or crew operating the dredges observes any kind of sheen or other indication of contaminants, they will immediately stop dredging or placement and notify the USCG and the Corps' environmental staff to determine the appropriate action.
5. Contractors will not release any trash, garbage, oil, grease, chemicals, or other contaminants into the water.
6. If routine or other sediment sampling determines that dredged material is not acceptable for unconfined, in-water placement, then a suitable alternative placement plan will be developed in cooperation with NMFS, EPA, Oregon Department of Environmental Quality (ODEQ), and other applicable agencies. The local sponsor is responsible for permitting any beneficial use upland placement, if proposed.
7. The Corps works to meet state water quality standards as set forth in the ODEQ Water Quality Certification. Water turbidity is required to not exceed 10% above natural stream turbidities except where allowed by Oregon Administrative Rules (OAR) 340-041-0205(2)(c). For project areas with coarse-grained sediments, turbidity levels will be monitored via visual observations to identify any adverse detectable change in water quality. In areas where fine-grained sediments are present in levels equal to or greater than 20% silts/clay (e.g., in Coos Bay between river mile (RM) 12 to 15 or in a number of the boat basin access channels), a turbidimeter is used to quantify change as nephelometric turbidity units (NTUs).
8. Placement activities at the ODMDS are performed in accordance with the Site Management and Monitoring Plan developed under 40 CFR 228.9 and with use restrictions specified as part of the EPA designation for these sites. Material is dispersed as thinly and evenly as possible to prevent mounding and reduce impacts to marine organisms.
9. When using a hydraulic cutterhead (pipeline) dredge, with material placed in an in-bay placement site, work is restricted to the ebb tide, so material dispersed to the maximum extent possible and turbidity is reduced.

1.3.5 Individual Project Actions

Tillamook Bay

The Tillamook Bay Federal navigation project (Figure 4) provides a stabilized entrance from the ocean for vessels serving Tillamook Bay up to the city of Tillamook and the Port of Garibaldi, about five miles inland from the southeastern corner of the Bay. The project includes a 5,700-foot-long jetty on the north side of the entrance to Tillamook Bay, an 8,000-foot-long jetty on the south side, an entrance channel, and an access channel to the Garibaldi boat basin. The entrance channel is -18 feet deep MLLW and as wide as can be practically and economically maintained across the ocean bar to deep water in the bay. The authorized channel from deep water to the Garibaldi boat basin near RM 3.2 is -12 feet deep, 100 feet wide, and approximately 1,200 feet long (approximately 2.75 acres). Only the Garibaldi boat basin access channel, as well as portions of the entrance channel and turning basin directly adjacent to the access channel, is regularly sampled and dredged by the Corps for maintenance. The dredging of these portions of the entrance channel and turning basin are required for access to the boat basin, and are implicitly included when discussing dredging of the access channel. For this project, the Corps proposes to continue maintenance dredging of the Garibaldi boat basin access channel, which includes the adjoining portions of the entrance channel and turning basin. Bathymetric surveys from the 1980s to 2010 show the entrance has not shoaled to the six meter depth limit to require dredging (Demirbilek *et al.* 2013). Therefore, maintenance dredging of the Tillamook Bay Entrance Channel is not forecasted at this time. However, if the need arose for the Corps to dredge the Tillamook Bay entrance channel, they would work with NMFS to obtain ESA coverage through consultation under section 7 of the ESA.

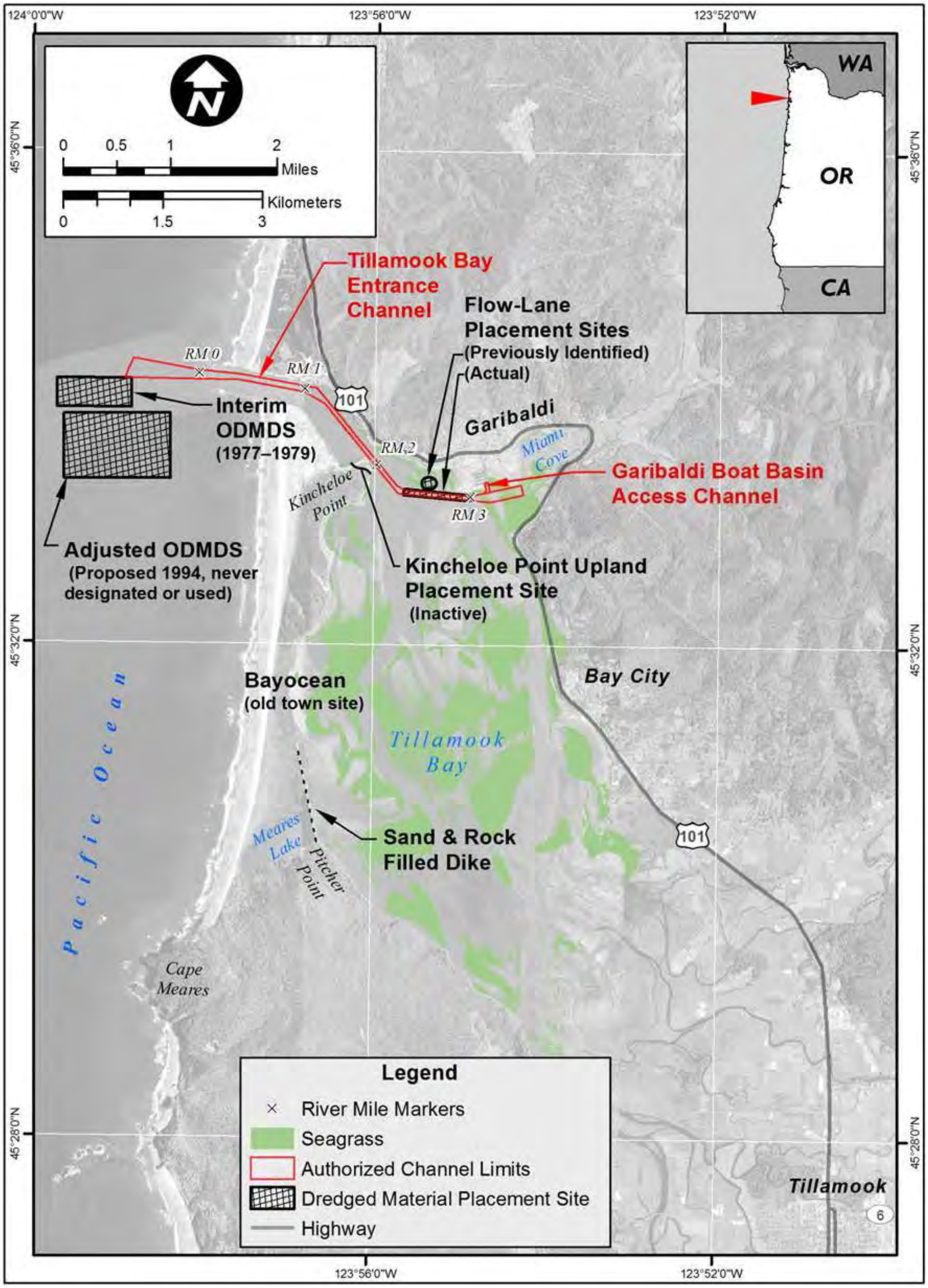

Figure 4. The Tillamook Bay project with identified seagrass beds.

The frequency of maintenance dredging has been variable over the years, depending upon the volume and location of sediments transported to and deposited in the estuary. Dredging will occur once every 5 to 8 years at the Garibaldi boat basin access channel. Maximum dredge depth is -14 feet MLLW, including 2 feet of advanced maintenance dredging. A maximum 50,000 cubic yards (cy) of material will be removed each dredging event, which includes all payable dredged material to the allowable overdepth. At this project, the number of dredging days is 45 days between July 15 and March 15.

For this project, the Corps would use either a hydraulic cutterhead or mechanical (clamshell) dredge to conduct dredging. Placement of dredged materials would occur at the flow-lane placement site because of the dispersive nature of the site, with sediments moving downstream towards the mouth of the bay. The sediments are mostly fine-grained sands originating from fluvial outflow from the rivers that flow into Tillamook Bay, marine sands from coastal erosion, and dredged material placement.

The 2016 BA provided an updated map for the 2017 biological opinion identifying the actual flow-lane placement site which had been incorrectly mapped for the 2010 biological opinion (Figure 5). Based on a review of the Corps' dredging activities at Tillamook Bay over the last 13 years, it does not appear that the Corps has in fact ever used the incorrectly mapped site, but instead placed dredged material in the actual flow lane (prior to that most placement was to the upland site at Kincheloe Point). The Corps intends to continue placing dredged material in the actual flow lane at Tillamook Bay (Figure 5). The Corps only places sediments during an ebb tide to prevent material moving back into the work area.

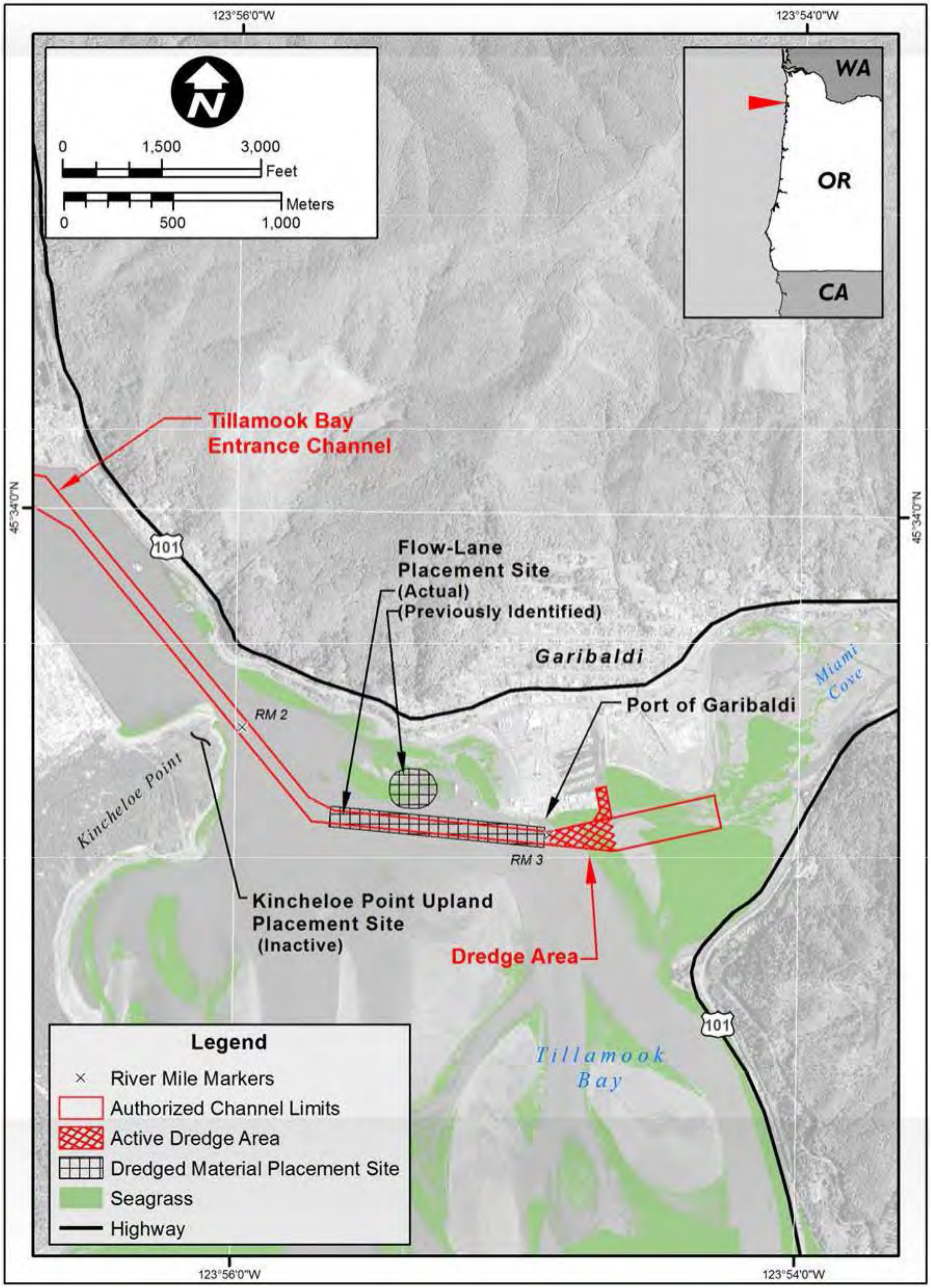

Figure 5. Tillamook Bay dredging and dredged material placement site.

Depoe Bay

Depoe Bay is a moorage for commercial, charter, and recreational fishing boats. The Depoe Bay project includes two breakwaters north of the entrance to Depoe Bay and an entrance channel that is -8 feet MLLW and 50 feet wide. The inner basin is -8 feet and 750 feet long and averages 390 feet wide (Figure 6). A concrete retaining wall was built along the east side of the boat basin. A small sediment check dam at the mouth of South Depoe Bay Creek helps to intercept sediments before they reach the bay (Figure 6). The local sponsor is the City of Depoe Bay. The entrance channel is self-scouring and no dredging is proposed at this time. The Depoe Bay boat basin and the South Depoe Bay Creek sediment check dam are proposed for continued maintenance dredging.

In fall of 2020, the Corps notified us of their need to conduct dredging at the sediment check dam. Subsequent collaboration between the Corps, NMFS, and Oregon Department of Fish and Wildlife resulted in the need for the Corps to conduct work area isolation, fish salvage, and dewatering prior to dredging. The effects of these activities on ESA-listed species or EFH were not analyzed in our 2017 biological opinion. Thus, the Corps requested ESA coverage under the SLOPES in-water/over-water structures biological opinion for dredging the sediment check dam in 2021. Their notification package included a work area isolation, fish salvage, and dewatering plan that would be implemented prior to dredging. To accommodate future dredging beyond 2021 at the sediment check dam, the Corps proposed the isolation and dewatering plan (Section 6.1 Appendix A) as part of the activities that will occur for dredging the sediment check dam.

Depoe Bay boat basin. Corps maintenance dredging of the boat basin will occur once every 5 to 8 years to the authorized depth of -8 feet MLLW, with a maximum dredge depth of -10 feet, including 2 feet of advanced maintenance dredging. The Corps will remove a maximum of 25,000 cy of material per dredging event, which includes all payable material to the allowable overdepth. The dredging method is hydraulic cutterhead (pipeline) or mechanical (such as clamshell). Operations are anticipated to take place for a maximum of up to about 30 days from July 1 to March 15. The Corps will continue to place dredged material from the boat basin at the intertidal placement area, which includes a surf zone site where material is placed on intertidal rocks and washes down into the water.

Sediment check dam. Maintenance dredging will occur behind the check dam in the catch basin every 5 to 8 years. Dredging will occur in 2021, however this opinion and the proposed activities described below will apply to future dredging events beyond 2021. Maximum dredge depth will be -4 feet MLLW including advanced maintenance dredging of -1 foot. Up to 2,000 cy of material will continue to be removed each dredging event, which includes all payable dredged material to the allowable overdepth. Prior to dredging the Corps will implement a work area isolation and dewatering plan (Section 6.1 Appendix A). The proposed dredging methods are hydraulic cutterhead (pipeline), or mechanical (such as clamshell or dragline). Operations would take place for about seven days from July 1 to September 15. The Corps will continue to place dredged materials at the intertidal placement site or at a sponsor-provided upland site. At this time, the Corps has not identified any upland sites.

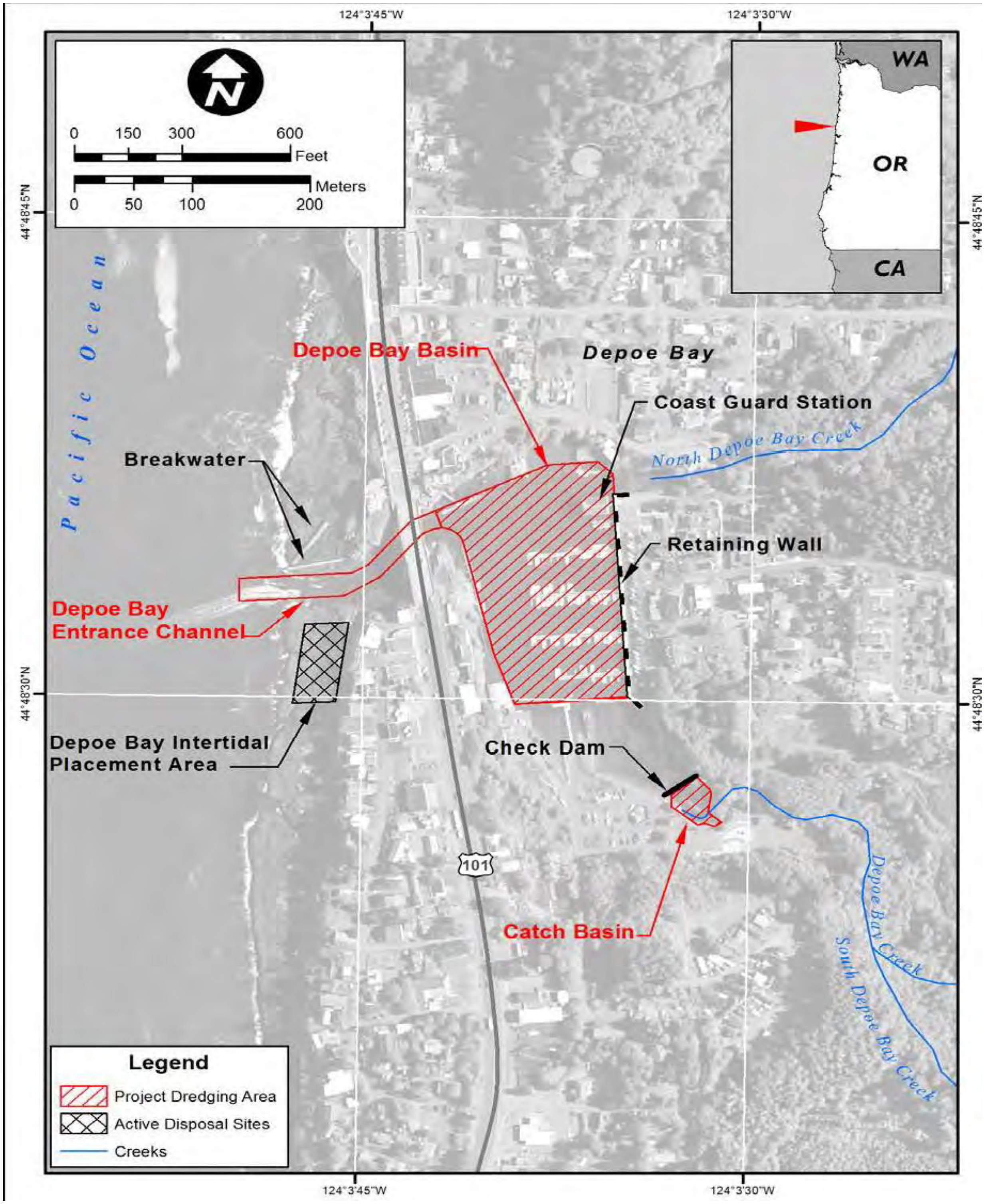

Figure 6. Depoe Bay dredging and dredged material disposal sites.

Yaquina Bay and River

The Yaquina Bay and River Federal navigation projects include two high tide rubble mound jetties at the entrance. The north jetty is 7,000 feet long and the south jetty is 8,600 feet long. The Yaquina Bay and River project include the Yaquina Bay entrance channel, South Beach Marina access channel, and the Yaquina River navigation channel (Depot Slough) and are all proposed for continued maintenance dredging. Dredged material disposal will occur at two ODMDS s. Both sites are 4,000 feet by 6,500 feet covering 597 acres with depths ranging from -112 to -152 feet below MLLW. Upland disposal would occur at an approved upland disposal site provided by the sponsor. The local sponsors are the Port of Newport and the Port of Toledo.

Yaquina Bay entrance channel. The Entrance Channel reach extends from RM -1 to RM 4.4 (Figure 7). Maximum dredge depth will be -45 feet (RM -1 to RM 0), -32 feet (RM 0 to RM 2+20), and -20 feet (RM 2+20 to 4+20) as measured from MLLW, including advanced maintenance dredging. The Corps proposed a maximum of 450,000 cy per dredging season. The Corps will conduct dredging annually at the entrance channel over 46 days during a June 15 to October 31 work period with 6 days needed in April or May to clear the entrance channel of shoals that accumulate during winter storms. The proposed dredging methods are hopper, hydraulic cutterhead (pipeline), or mechanical (such as clamshell or dragline).

South Beach Marina access channel. The South Beach Marina access channel (Figure 7) is approximately 2,035 feet long and runs from Yaquina RM 1 to the South Beach Marina. Dredging will occur once every 5 to 8 years where the maximum dredged depth will be -12 MLLW, which includes 2 feet of advanced maintenance dredging. The Corps will dredge up to 25,000 cy of material each dredging event, which includes all payable dredged material to the allowable overdepth. The Corps' proposed dredging methods are hydraulic cutterhead (pipeline) or mechanical. The Corps anticipated dredging to take about 30 days from July to October 1, although additional days may sometimes be necessary depending on sea conditions and how much material can be safely moved to the two ODMDS on the dredge barge.

Yaquina River navigation channel (Depot Slough). The Yaquina River is authorized for a channel depth of -10 feet deep running from RM 4+20 to RM 14 at a general width of 150 feet (Figure 8). At Toledo, the width widens to 200 feet and extends into Depot Slough at RM 13. A turning basin is on the south side of the river at RM 14 and is 350 feet wide and 500 feet long. Only Depot Slough is proposed for continued maintenance dredging, which will occur once every 5 to 8 years. Maximum dredge depth will be -12 MLLW, including 2 feet of advanced maintenance dredging. The Corps will dredge a maximum 100,000 cy per dredging event, which includes all payable material to the allowable overdepth. The Corps will use either the hopper, hydraulic cutterhead, or mechanical method for removal with the most likely being the mechanical dredging method. The Corps anticipates about 30 days from July 1 to October 31 for dredging, although a few additional days may be necessary depending on sea conditions and how much material can be safely moved to the ODMDS on the dredge barge. The local sponsor is the Port of Toledo.

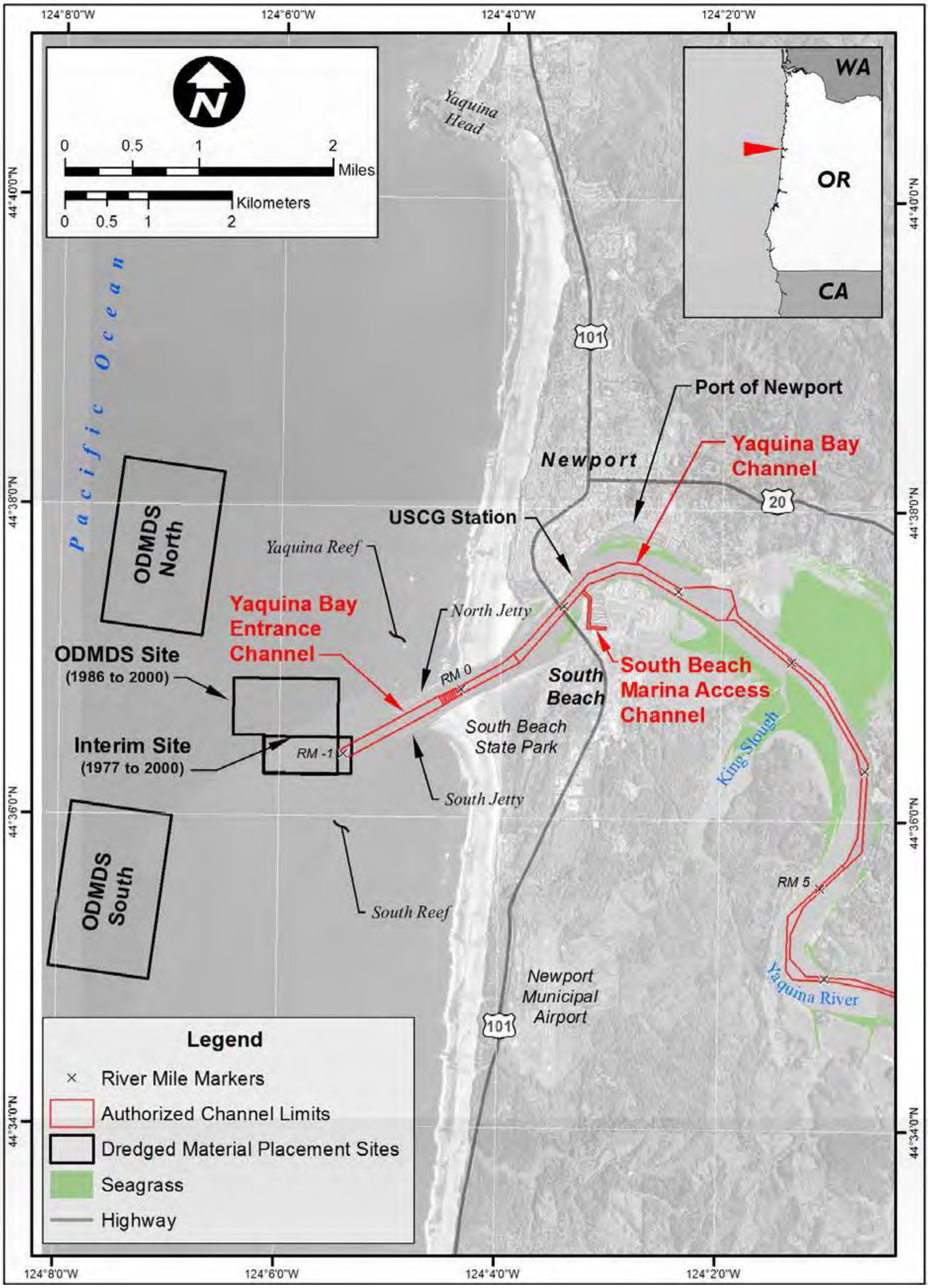

Figure 7. Lower Yaquina Bay and South Beach Marina.

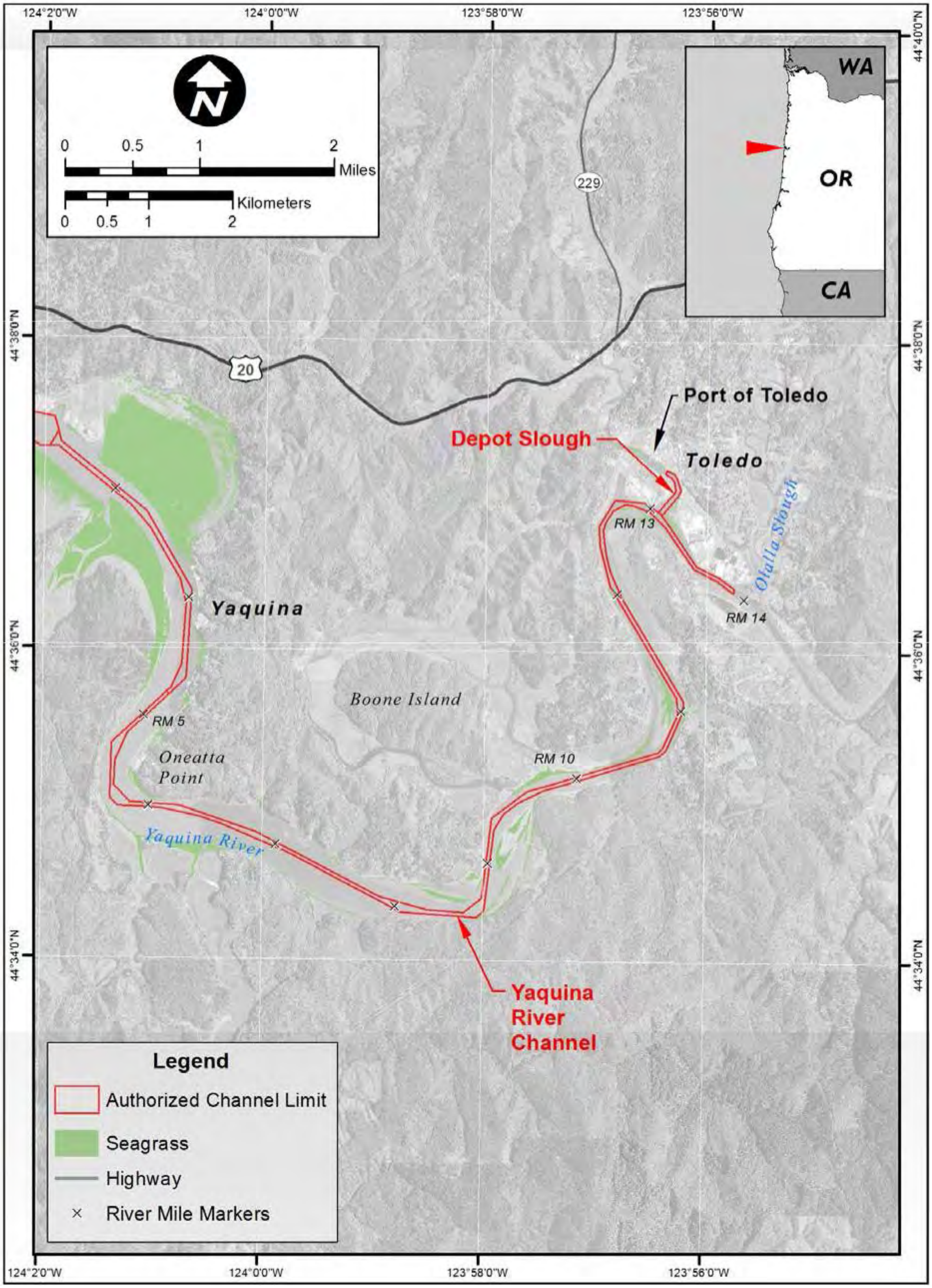

Figure 8. Upper Yaquina Bay and River and Depot Slough.

Siuslaw River

The Federally authorized Siuslaw River navigation project includes two high-tide jetties that are 750 feet apart at their outer ends. Both were extended in 1986, the north jetty from 7,790 to 9,690 feet and the south jetty from 4,200 to 6,000 feet. Spur jetties that are 400 feet long also were added to the jetty extensions. The entrance channel is authorized at -23 feet from RM -1 to RM 0.2 and -18 feet deep from RM 0.2 to RM 5 (Figure 9), including advanced maintenance dredging. The Corps will maintain the entrance channel at 300 feet wide to RM 0.2 and 200 feet wide from RM 0.2 to RM 5. A turning basin opposite the dock is -16 feet deep, 400 feet wide and 600 feet long. There is an unmaintained, authorized channel -12 feet deep and 150 feet wide from Florence to RM 16.5 with a turning basin at RM 15.8 (Figure 9 and 10), which is 300 feet wide and 500 feet long. Dredging will occur annually, except for the turning basin, which at dredging will occur once every 5 to 8 years. The Corps will remove 100,000 cy per dredging event, which includes all payable material to the allowable overdepth with an additional 100,000 cy every 5 to 8 years when the turning basin is dredged. The Corps' proposed dredging methods for this project are hopper, hydraulic cutterhead (pipeline), or mechanical (such as clamshell or dragline. Dredging will take 20 days with an additional 20 days every 5 to 8 years when the turning basin is dredged during the June 1 to October 31 period.

The Corps will place dredged material at one of two ODMDS (north or south). The north ODMDS is about 4,800 feet long and 2,000 feet wide with an average depth of -90 feet MLLW; the south ODMDS is 3,000 long and 2,000 feet wide with an average depth of -78 feet MLLW. Upland disposal may occur at an approved site provided by the sponsor.

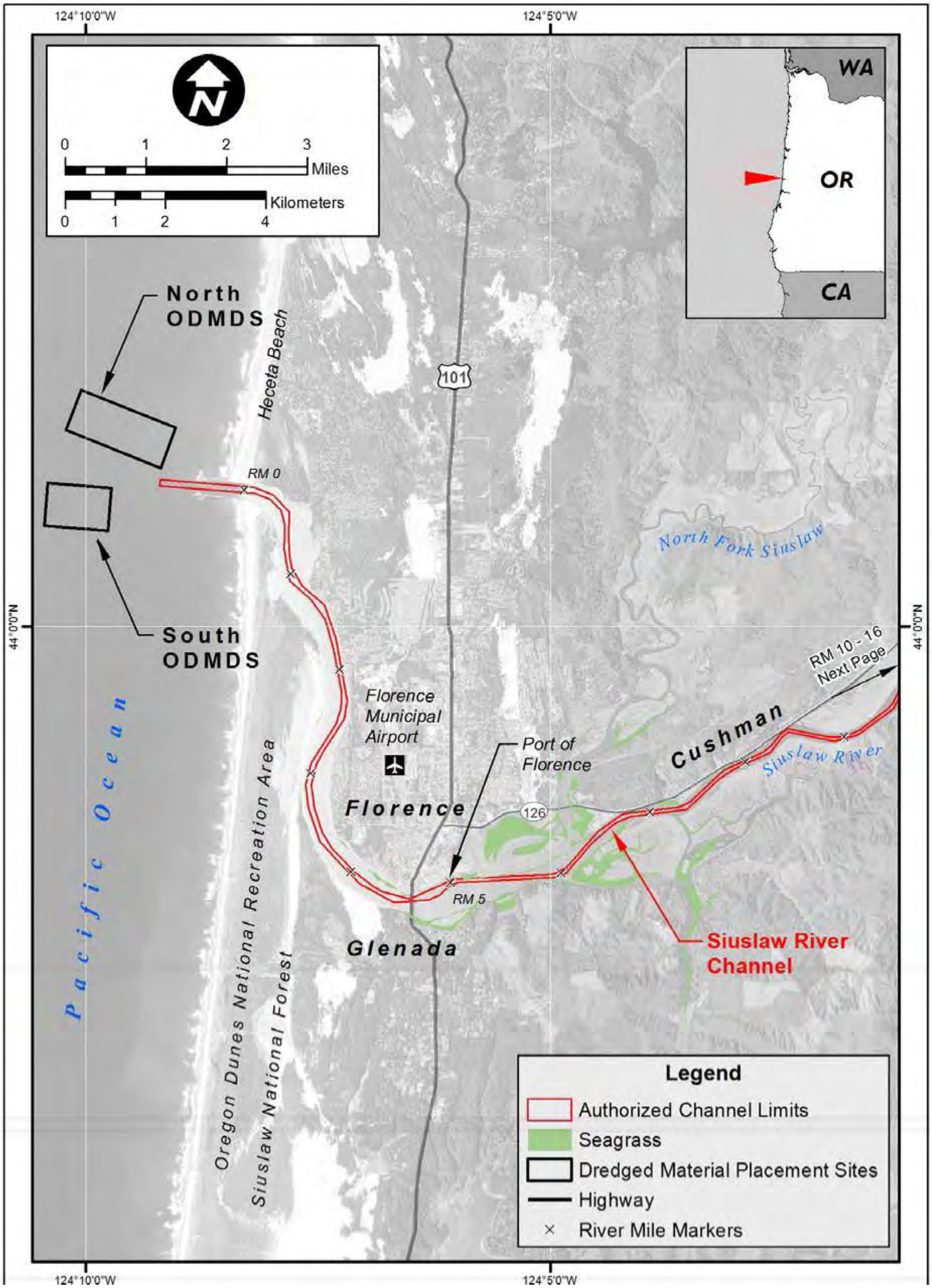

Figure 9. Lower Siuslaw River.

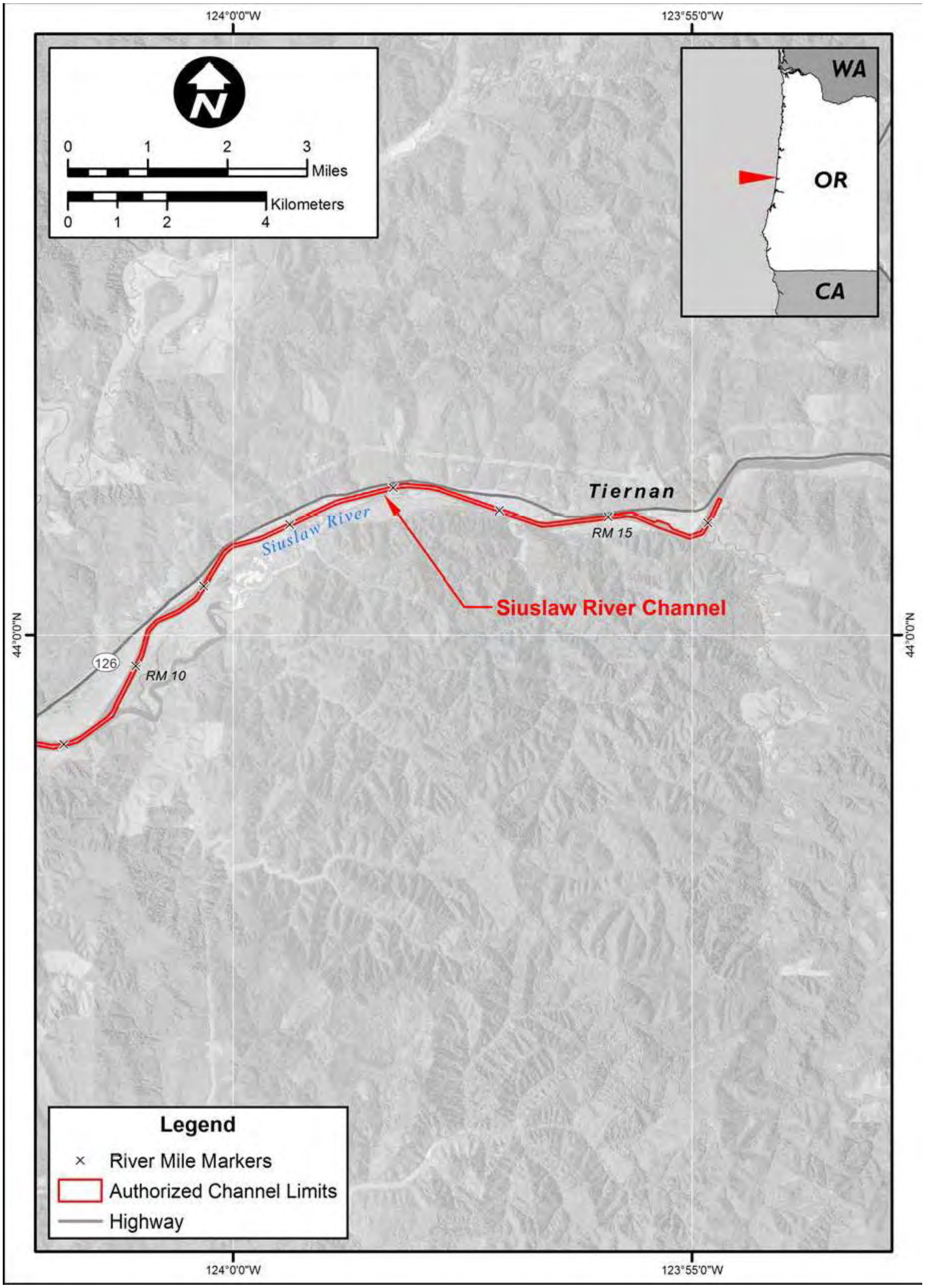

Figure 10. Upper Siuslaw River navigation channel.

Umpqua River

The Umpqua River project includes two jetties at the entrance; the north jetty is 8,000 feet long and the south jetty is 4,200 feet long. The Corps proposed three areas for continued maintenance dredging including the Umpqua River entrance channel, the Umpqua River navigation channel, and the Winchester Bay boat basin access channels in the west and east boat basins. Dredged material disposal will occur at two ODMDS north and south of the entrance channel. The ODMDSs are 6,300 feet long by 4,000 feet wide with depths ranging from -30 to -130 feet MLLW. The Corps may also dispose of dredged material at an in-bay site on the north side of the Umpqua River channel at approximately RM 1. The in-bay site is 1,000 feet long and -35 to -75 feet deep.

Umpqua River entrance and navigation channel. The entrance channel extends from RM -1 to RM 0-10 (0.8 mile) (Figure 11). The Corps will annually dredge the entrance channel to -31 feet MLLW, including 5 feet of advanced maintenance dredging. Removal of 150,000 cy of material will occur annually, including all payable dredged material to the allowable overdepth. The Corps proposed to use a hopper or mechanical (clamshell or dragline) dredge to maintain the entrance channel. The navigation channel extends from RM 0-10 to RM 11+40 (Figure 11). The Corps will dredge the navigation channel annually using either the hopper, hydraulic cutterhead (pipeline), or mechanical (clamshell or dragline) dredge. The Corps anticipate 4 days of dredging during April or May to clear the entrance channel of shoals that accumulate during winter storms 20 days during the July 1 to October 31 period to dredge the entrance and navigation channels.

Winchester Bay boat basin access channels. The west boat basin access channel is about 4,300 feet long and runs from RM 1+10 to the marina. The east boat basin channel is 4,500 feet and runs from RM 1+35 to the marina (Figure 11). The Corps will dredge the boat basin access channels annually to the authorized depth of -14 to -18 feet MLLW, including two feet of advanced maintenance dredging. The Corps will remove up to 25,000 cy of material per dredging event, including all payable material to the allowable overdepth. Hopper, hydraulic cutterhead (pipeline), and mechanical (clamshell or dragline) are the Corps' proposed dredging methods for this area. The Corps proposed dredging will occur over 30 days from July 1 to October 31.

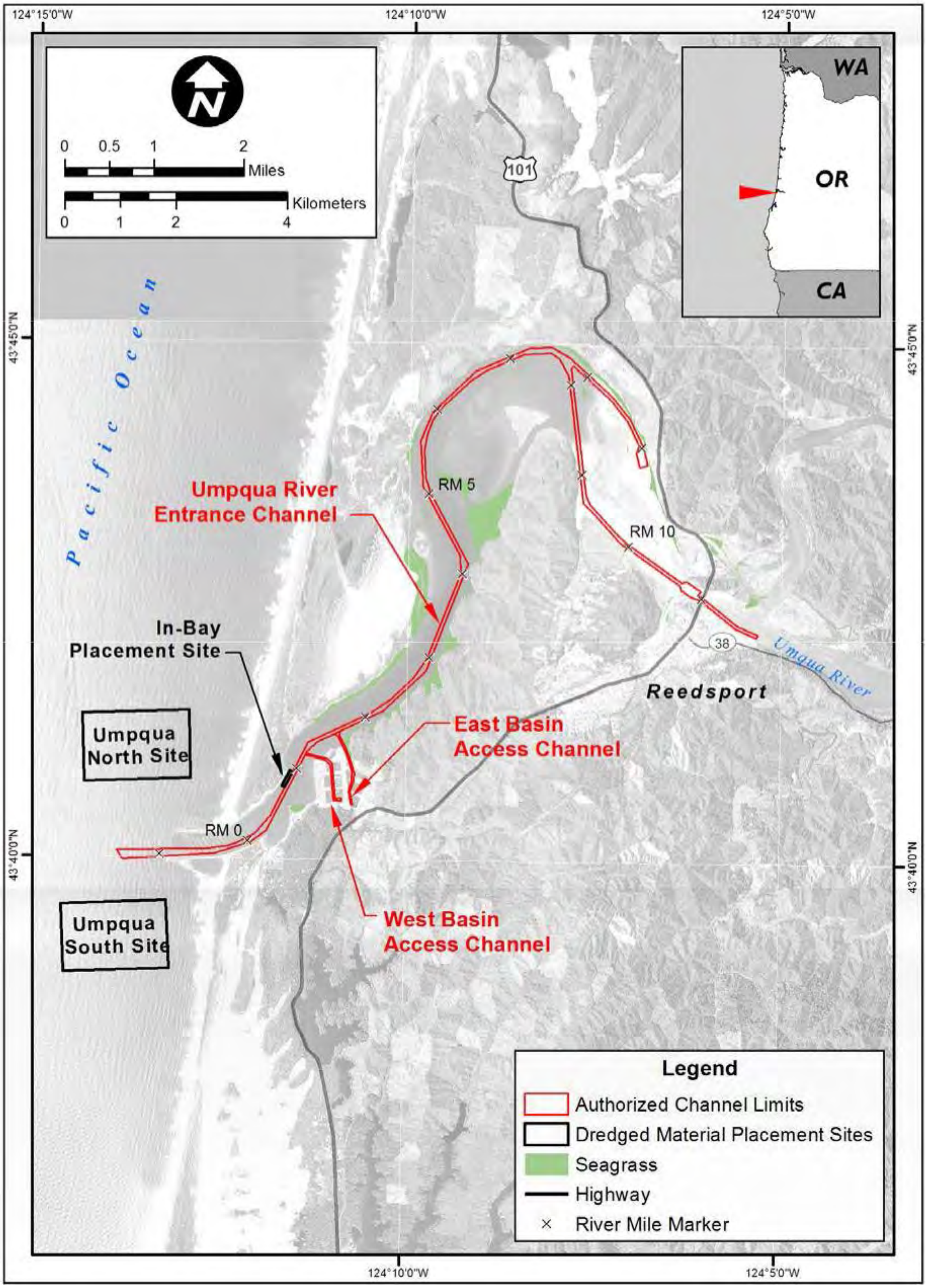

Figure 11. Umpqua River entrance, navigation, and boat basin access channels.

Coos Bay

The Coos Bay Federal navigation project includes north and south jetties that are 10,400 and 9,000 feet long. The Corps proposed four areas for continued maintenance dredging including the entrance channel, the lower navigation channel (RM 1 to 12), the upper navigation channel (RM 12 to 15), and the Charleston access channel (Figures 12 and 13). The location of dredged material disposal is variable depending on the area that the Corps is dredging and will be described in the individual project descriptions below.

Entrance channel. The Corps will annually dredge the entrance channel (RM -1 to 1) (Figure 12) to the maximum dredge depth of up to -52 feet MLLW, including 5 feet of advanced maintenance dredging. In this reach, advance maintenance dredging will continue up to -50 feet MLLW outside the channel limits in locations where there is a historical problem of infill. The Corps will dredge a maximum of 1 million cy of material per year, which includes all payable material to the allowable overdepth. The Corps will use a hopper or mechanical dredge over a period of 5 days in April or May and 20 days from June 15 to October 31, although a few more days may be needed depending on ocean conditions and how much material can safely be moved to the ODMDS.

The Corps will dispose of dredged material at ODMDS F which is 14,600 feet by 8,000 feet by 9,650 feet (trapezoidal) with an average depth of -80 feet and an area of 3,075 acres. Dredged material placement could occur at ODMDS E (dimensions 3,600 feet by 1,400 feet) which is -55 to -60 feet and an area of 116 acres. When the entrance channel bar is impassable, the Corps will place dredged material at an in-bay placement site (site G). Site G is on the south side of the channel and is about 200 feet wide by 1,000 feet long, approximately -40 to -45 feet deep within an area of 4.6 acres.

Lower navigation channel RM 1 to 12. The Corps will annually dredge the Coos River lower navigation channel from RM 1 to 12 (Figure 12 and 13) to a maximum depth of -40 feet MLLW, including 3 feet of advanced maintenance dredging. In this reach, advance maintenance dredging is also proposed to continue up to 50 feet outside the channel limits in locations where there is a historical problem with infill. The Corps will dredge a maximum of 300,000 cy of material per year, which includes all payable material to the allowable overdepth. The Corps will use a hopper, pipeline, or mechanical dredge over 35 days from June 15 to October 31 although a few more days may be needed depending on sea conditions and how much material can be safely moved to the ODMDS. Up to an additional six days may also be necessary in April and May to clear the lower portion of the channel of shoals that accumulate during winter storms.

Dredged material placement will continue to occur at ODMDS F (and ODMDS E, if needed), at an in-bay placement site at RM 8.4 adjacent to the North Bend Municipal Airport, or at in-bay Site G. Site 8.4 is a re-handle site on the south side of the channel, is about 300 feet wide by 2,500 feet long, -30 to -35 feet deep within an area of about 17 acres, and has a sand substrate and no vegetation. The Corps will continue to use site 8.4 for temporary storage of material dredged by the Corp's *Yaquina* hopper dredge for later ocean placement through contracted mechanical dredging. Placement of material at this site allows for more effective use of the *Yaquina* by reducing its non-productive time hauling loads to the ODMDS. Site 8.4 is nondispersive and material will continue to be dredged from this site on a 5 to 10 year frequency and placed at the ODMDS F. The Corps will, on occasion, continue to place dredged material at flow-lane Site G when the entrance channel conditions are too hazardous for transit to the ODMDS or when they use a pipeline dredge. The Corps will use Site G approximately 20 days each year for material taken from the Charleston Access Channel and the main Navigation Channel. When placing material at Site G with the pipeline dredge, the Corps will only do so during ebbing tides to allow the dispersal of material to the ocean.

Upper navigation channel RM 12 to 15. The Corps will annually dredge the Coos River upper navigation channel from RM 12 to 15 (Figure 13) to a maximum depth of -40 feet MLLW, including 3 feet of advanced maintenance dredging. The Corps will remove up to 1,000,000 cy of material per year, which includes all payable material to the allowable overdepth. The Corps will use a mechanical, hopper, or pipeline dredge over 100 days from July 1 to October 31, although a few more days may be necessary depending on sea conditions and how much material can be safely moved to the ODMDS.

The Corps will continue to place dredged material placement at ODMDS H, which has an average depth of -180 feet, or occasionally at in-bay Site 8.4. The Corps would use Site 8.4 about four days per year for material above RM 12 when it is not economically feasible to use ODMDS H.

Charleston access channel. The Corps will annually dredge the 6,500-foot Charleston access channel extending from RM 2 of the main channel to the Charleston Marina (Figure 12) to a maximum depth of -18 to -19 feet MLLW, including 2 feet of advanced maintenance dredging. Using a hopper, pipeline, or mechanical dredge, the Corps will remove up to 50,000 cy of material from this channel, including all payable material to the allowable overdepth. Dredging will occur over 30 days from July 1 to November 30, although a few more days may be needed depending on sea conditions and how much material could be moved safely to the ODMDS, or Site G when the Corps uses a pipeline dredge. An additional 9 days may also be necessary in April, May, or June to clear the access channel of shoals that accumulate during winter storms. Dredged material placement will continue to occur at ODMDS F (and ODMDS E, if needed) or at in-bay Site G as needed.

Any future proposed upland placement from dredging will require the local project sponsor (i.e. the Port of Coos Bay), to be responsible for obtaining all environmental clearances, permits and approvals for that site prior to its use.

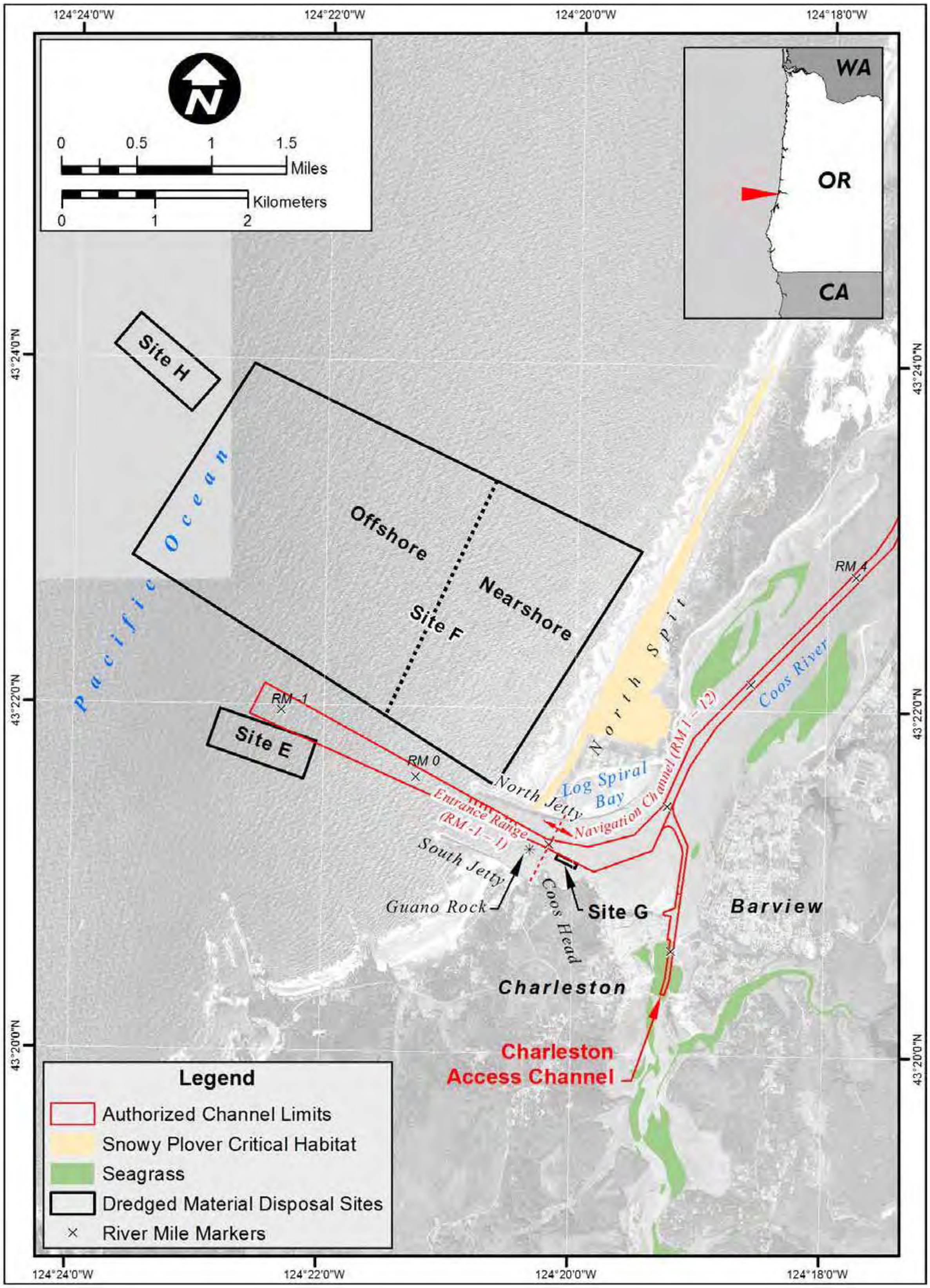

Figure 12. Lower Coos Bay.

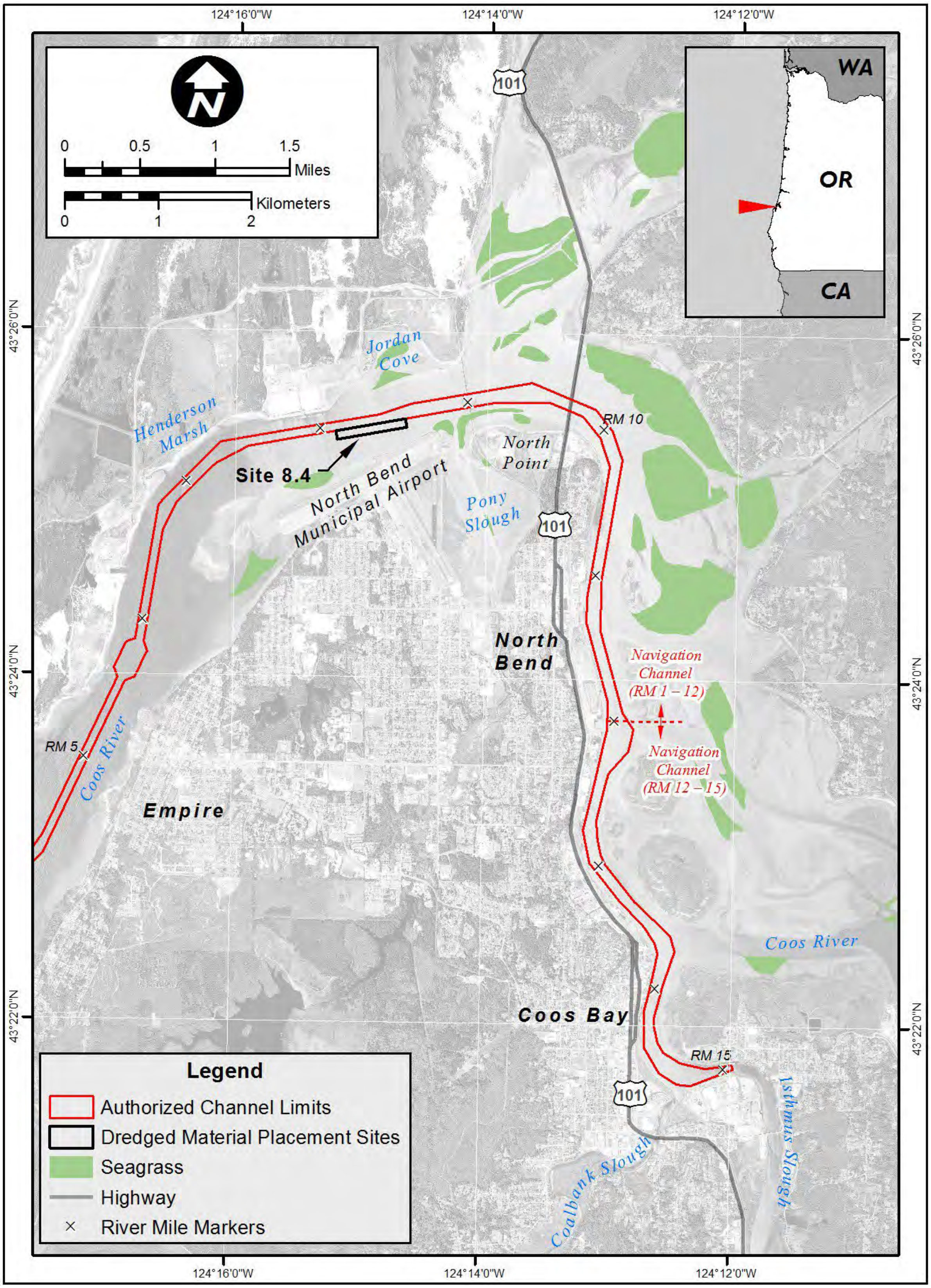

Figure 13. Upper Coos Bay.

Coquille River

The Coquille River Federal Navigation Project includes north and south jetties that are 3,450 and 2,700 feet long. The Corps proposed two areas for continued maintenance dredging including the Coquille River entrance Channel and the Bandon boat basin access channel (Figure 14). Dredged material placement will occur either at the ODMDS that is 3,500 feet by 1,750 feet, 1 mile offshore, and approximately -60 feet deep or at the in-bay flow-lane placement site located in the navigation channel at RM 1. The flow-lane placement site is -15 to -30 feet and is dispersive by river flow or tidal fluctuations.

Entrance channel. The Corps will annually dredge the entrance channel from RM 0-20 to RM 1+15 (1.7 miles) to a maximum dredge depth of -17 feet MLLW, including 4 feet of advanced maintenance dredging. Using a hopper or mechanical (clamshell or dragline) dredge, the Corps will remove a maximum of 38,000 cy of material, which includes all payable material to the allowable overdepth. Dredging and material placement will occur over 7 days from June 15 to October 31. The Corps will place dredged material from the entrance channel at the ODMDS.

Bandon boat basin access channel. Every 5 to 10 years, the Corps will dredge the Bandon boat basin access channel to a maximum depth of -15 feet MLLW, including two feet of advanced maintenance dredging. Using a hopper, mechanical (clamshell or dragline), or pipeline dredge, the Corps will remove 9,000 cubic yards of material, which includes all payable material to the allowable overdepth. Dredging and material placement would occur over 14 days from July 1 to November 30 after dredging the entrance channel. The Corps would place material from the boat basin access channel at the ODMDS or the in-bay flow-lane displacement site located at RM 1.

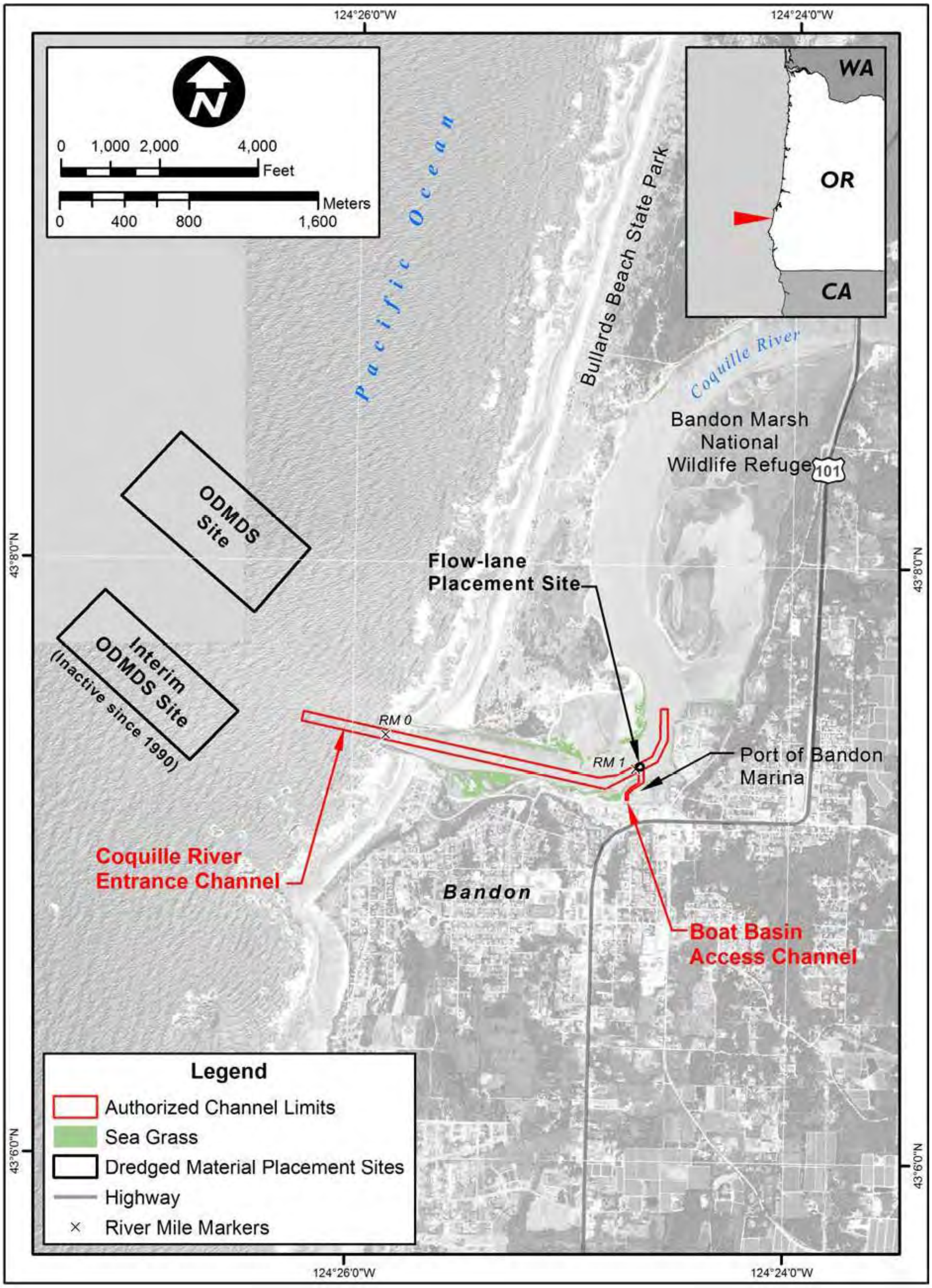

Figure 14. Coquille River project.

Port Orford

Port Orford is unique among ports on the Oregon Coast in that it is not located on a river channel, but rather on an open bay. Port Orford is the West Coast's only 'dolly' port; vessels home-ported here are limited in size, since they are hoisted in and out of the water by two cranes located on the Dock.

The Port Orford Federal Navigation Project consists of the Corps' breakwater (550 feet long) and the turning basin (-16 feet deep, 900 feet wide and 750 feet long). The Corps proposed two areas for continued maintenance dredging including the navigation channel and the area around the boat hoist called the dock face (Figure 15). The Corps typically places the dredged material in the nearshore placement site located 200 feet south of the breakwater head or the breakwater placement site. The Port of Port Orford is the local sponsor.

Navigation channel. The Corps will annually dredge the navigation channel to a maximum depth of -16 feet MLLW plus 4 feet of advanced maintenance dredging and an additional 3 feet for allowable overdepth for a total depth of -23 feet MLLW. Using a mechanical or pipeline dredge, the Corps will remove up to 45,000 cy of material, which includes all payable material to the allowable overdepth. Dredging will occur over 50 days from May 1 to October 31. Disposal of dredged material will occur at the nearshore placement site.

Dock face. The Corps will annually dredge the dock face to -16 feet MLLW with an additional 4 feet for advanced maintenance for a total of -20 feet MLLW. The Corps will remove up to 7,000 cy using a pipeline driven by a submersible slurry pump from the Port dock. Port dock dredging will normally occur in two to five increments between May 1 and April 15.

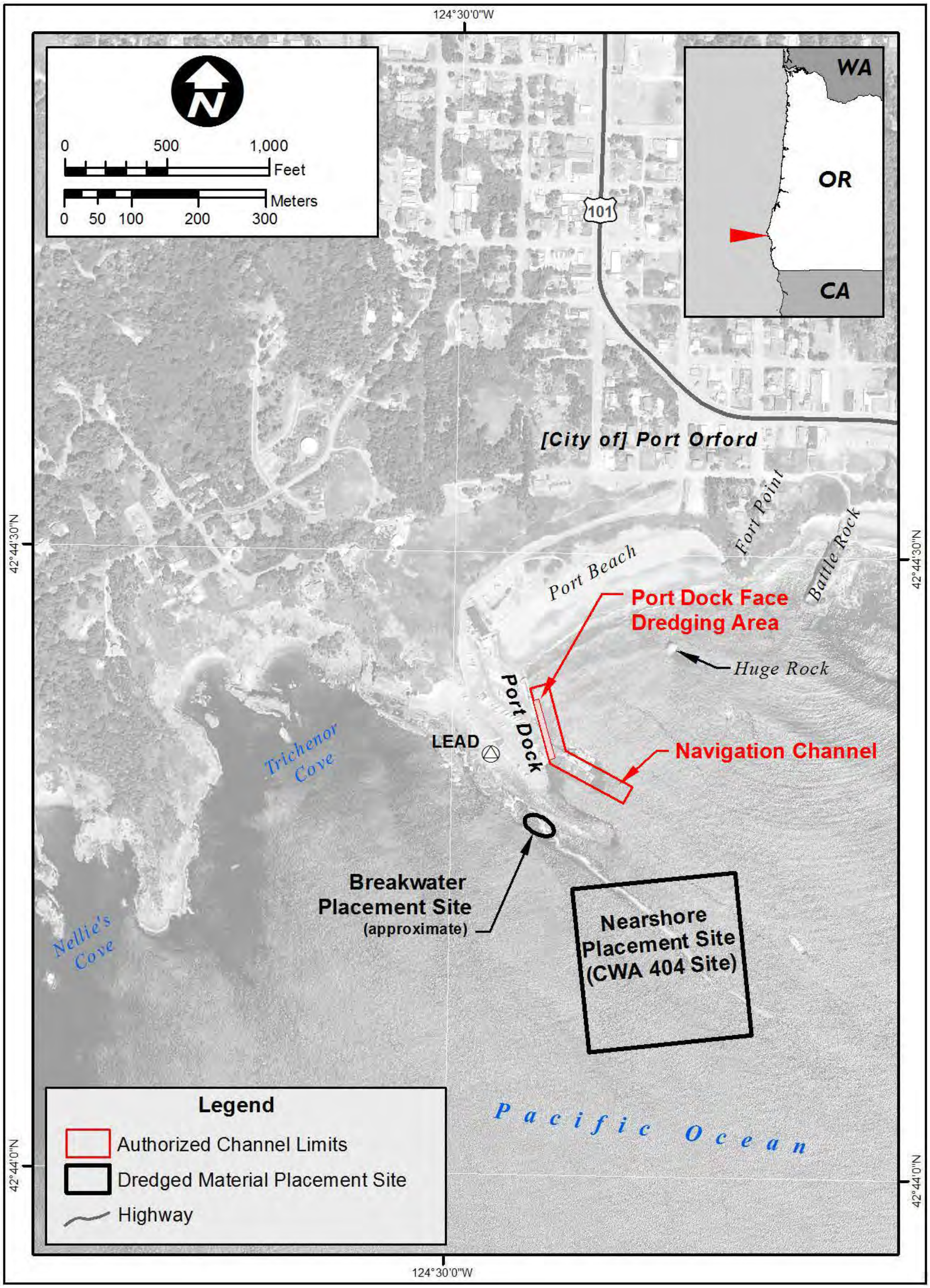

Figure 15. Port Orford project.

Rogue River

The Rogue River Federal Navigation project includes north and south jetties and the navigation channel through to the Gold Beach boat basin. The Corps proposed two areas for continued maintenance dredging including the Rogue River entrance channel and the Gold Beach boat basin access channel (Figure 16). A third area is proposed for one-time maintenance in 2021, namely, the large gravel bar that has formed upstream of the boat basin access channel that is encroaching on the access channel and may be the source of increased sediments in the mainstem portions of the navigation channels. Dredged material placement will occur at either the ODMDS, an upland re-handling area, or adjacent to the Gold Beach Airport in the South Beach surf zone where material is placed directly on the beach. The ODMDS is 3,600 feet long by 1,400 feet wide, approximately 116 acres, and varies in depth from -40 to -80 feet MLLW. The Port of Gold Beach is the local sponsor.

Entrance channel. The Corps will annually dredge the Rogue River entrance channel to a maximum depth of -20 feet MLLW, including 4 feet of advanced maintenance dredging with an allowable overdepth of 3 feet. The Corps will use a hopper or mechanical dredging to remove up to 130,000 cy of material, which includes all payable material to the allowable overdepth. Dredging the entrance channel will occur over 65 days between June 1 and October 31, although a few more days may be needed depending on sea conditions and how much material can be safely moved to the ODMDS.

Gold Beach boat basin access channel. The Corps will dredge the Gold Beach boat basin access channel every 5 to 10 years to a maximum depth of -15 feet MLLW, including 2 feet of advanced maintenance dredging, with an allowable 3 feet overdepth. Using a hopper, mechanical, or pipeline dredge, the Corps will dredge up to 75,000 cy of material over 50 days between July 15 to October 31, although, a few more days may be needed depending on sea conditions and how much material can be safely moved to the ODMDS. Dredged material placement will occur at the ODMDS, an upland re-handling area, or adjacent to the Gold Beach airport in the south beach surf zone where material is placed directly on the beach.

In May 21, 2015, the Corps broke the boat basin access channel in two portions, an inner and outer portion. Based on the results of sediment sampling conducted in the inner portion on September 18, 2012, July 21, 2014, and May 4, 2015, which identified phenol concentrations well above the SEF (RSET 2016) screening levels, the inner portion was determined to be unsuitable for unconfined in-water placement. The Corps will not dredge the inner portion of the boat basin access channel until a suitable upland disposal site has been identified and additional environmental clearances obtained.

AMD gravel bar (2021 only). The Corps proposes to remove a large gravel bar that is currently impeding access to the Gold Beach Boat Basin and access channel. The dredging prism is approximately 1600 feet long by 450 feet wide by 11 feet deep. The gravel bar has a current depth of +3 feet MLLW (3 feet above 0 MLLW on average) and the Corps plans to remove up to 200,000 cy of material using a mechanical (e.g., clamshell) dredge. The Corps would conduct dredging of the gravel bar from 15 June - 31 October. The Corps would avoid any disturbance to the fine sediments in the breakwater gap and into the inner part of the boat basin access channel.

The shoal is dominated by cobbles, gravels and sands, based on data from adjacent sediments in this reach, and is suitable for in-water placement. Thus, material will be placed in the currently authorized ODMDS site. Based on a maximum 200,000 cubic yards of material, there could be up to 500 barge loads to the ODMDS site and will take up to 150 days.

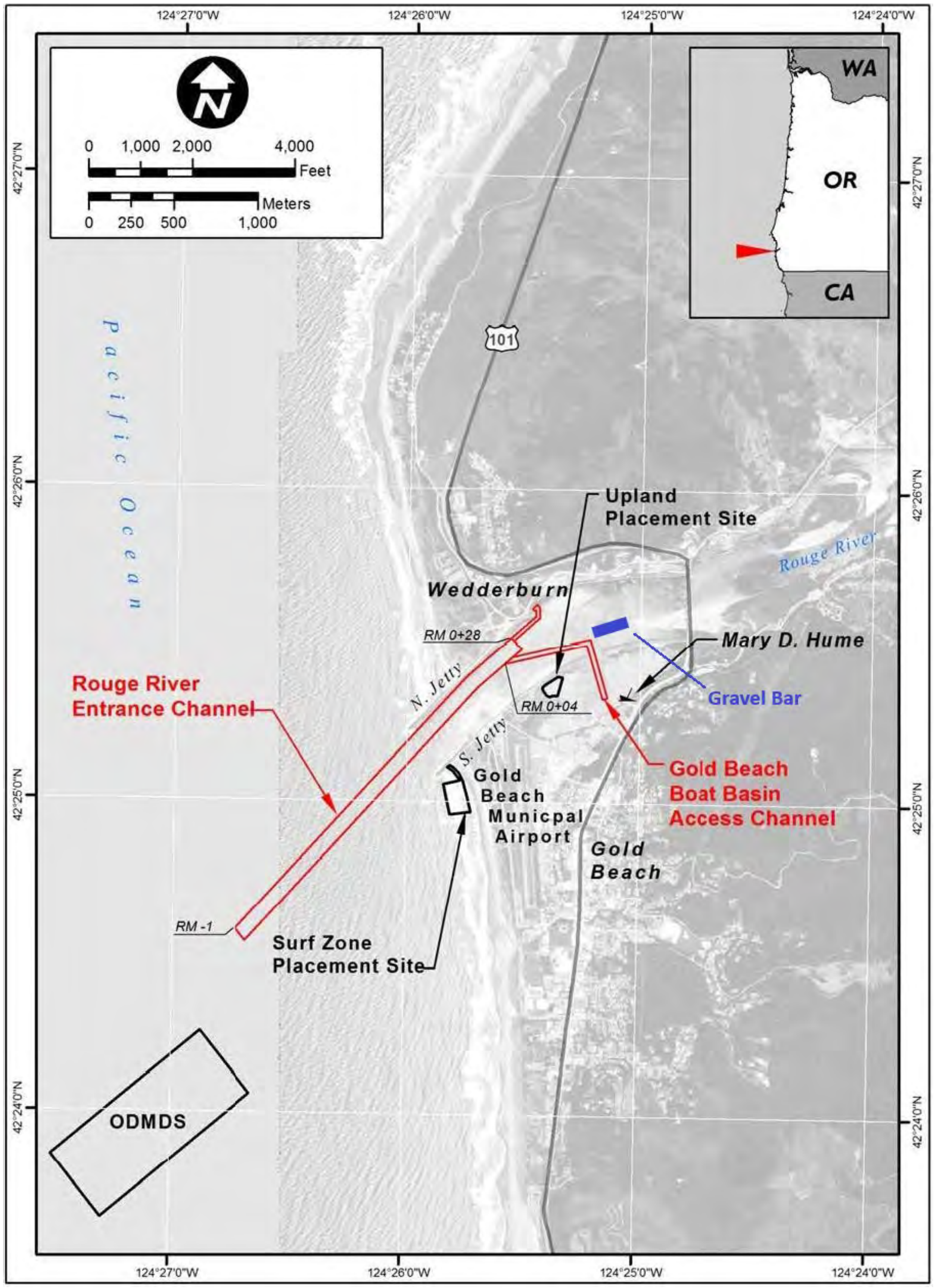

Figure 16. Rogue River project.

Chetco River

The Chetco River Federal Navigation project includes two rock jetties at the entrance to the Chetco River and the navigation channel up to the boat basin. The Corps proposed two areas for continued dredging including the entrance channel and the commercial boat basin access channel and turning basin (Figure 17). Dredged material disposal will occur at the nearshore placement site and at the ODMDS approximately 1.5 miles offshore. The nearshore placement site is defined by the following coordinates:

Longitude	Latitude
-124.26840	42.03772
-124.27246	42.03998
-124.26942	42.04286
-124.26604	42.03987

The Corps proposed that disposal will occur in an area 1,425 feet long and 440 feet wide area within the larger area defined by the coordinates above, but the location of the smaller area will vary from year to year depending on the pre-dredging bathymetry conditions prior to that year's dredging. This will allow the Corps to maximize the use of the site as the beach naturally builds and recedes. The overall larger area ranges in depth from -16 feet to -30 feet MLLW. The Port of Brookings is the local sponsor.

Entrance channel. The Corps will dredge the entrance channel annually from RM 0-20 to RM 0+30 to a maximum depth of -21 feet MLLW, including 4 feet of advanced maintenance dredging. The Corps will use a hopper or mechanical dredge to remove a maximum of 70,000 cy of material annually, which includes all payable dredged material to the allowable overdepth. Dredging of the entrance channel will occur for 12 days from June 1 to October 31, although a few more days may be necessary depending on sea conditions and how much material can be safely moved to the ODMDS.

Brookings-Harbor commercial boat basin access channel and turning basin. The Corps will dredge the boat basin access channel every 5 years from 600 feet from RM 0+15 to the south boat basin to a maximum dredge depth of -17 feet MLLW including 2 feet of advanced maintenance dredging with an allowable 3 feet of overdepth. For the turning basin, the Corps will dredge to a maximum depth of -19 feet MLLW including 2 feet of advanced maintenance dredging, with an allowable 3 feet of overdepth. The Corps will use a hydraulic cutterhead (pipeline) or mechanical (clamshell or dragline) dredge. Disposal of dredged material from these areas will only occur at the ODMDS. Dredging of these areas will occur for 14 days from July 15 to October 31, although a few more days may be necessary depending on sea conditions and how much material can be safely moved to the ODMDS.

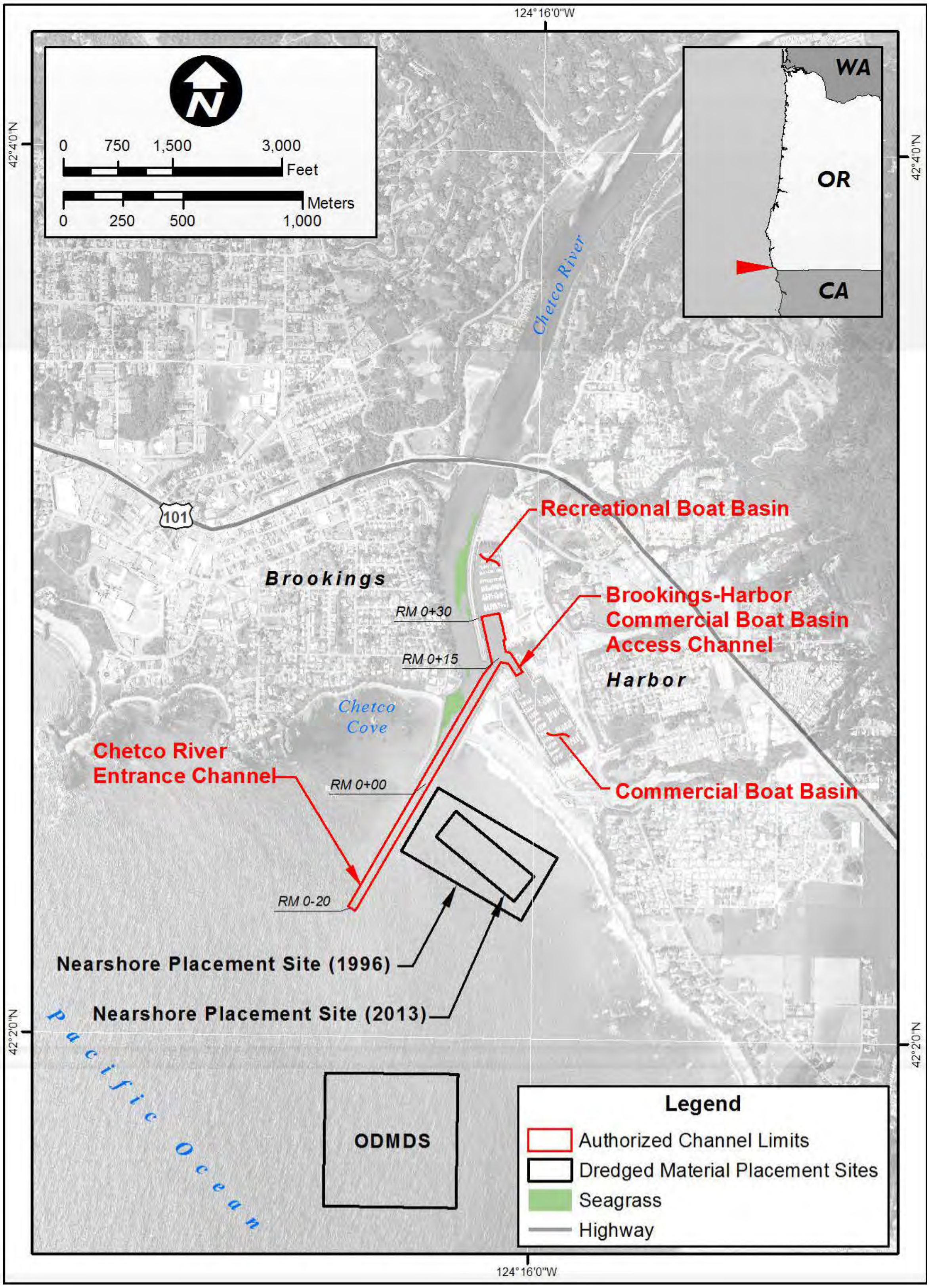

Figure 17. The Chetco River project.

2. ENDANGERED SPECIES ACT: BIOLOGICAL OPINION AND INCIDENTAL TAKE STATEMENT

The ESA establishes a national program for conserving threatened and endangered species of fish, wildlife, plants, and the habitat upon which they depend. As required by section 7(a)(2) of the ESA, each Federal agency must ensure that its actions are not likely to jeopardize the continued existence of endangered or threatened species, or adversely modify or destroy their designated critical habitat. Per the requirements of the ESA, Federal action agencies consult with NMFS and section 7(b)(3) requires that, at the conclusion of consultation, NMFS provide an opinion stating how the agency's actions would affect listed species and their critical habitats. If incidental take is reasonably certain to occur, section 7(b)(4) requires NMFS to provide an ITS that specifies the impact of any incidental taking and includes non-discretionary reasonable and prudent measures (RPMs) and terms and conditions to minimize such impacts.

The Corps determined the proposed action is not likely to adversely affect southern DPS eulachon, seven species of marine mammals, four species of marine turtles, designated critical habitat for southern DPS eulachon and leatherback turtles, or proposed critical habitat for Southern Resident killer whales. Our concurrence is documented in the "Not Likely to Adversely Affect" Determinations section (Section 2.13).

2.1. Analytical Approach

This biological opinion includes both a jeopardy analysis and an adverse modification analysis. The jeopardy analysis relies upon the regulatory definition of "jeopardize the continued existence of" a listed species, which is "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Therefore, the jeopardy analysis considers both survival and recovery of the species.

This biological opinion relies on the definition of "destruction or adverse modification," which "means a direct or indirect alteration that appreciably diminishes the value of critical habitat as a whole for the conservation of a listed species" (50 CFR 402.02).

The designation(s) of critical habitat for (species) use(s) the term primary constituent element (PCE) or essential features. The 2016 critical habitat regulations (50 CFR 424.12) replaced this term with physical or biological features (PBFs). The shift in terminology does not change the approach used in conducting a "destruction or adverse modification" analysis, which is the same regardless of whether the original designation identified PCEs, PBFs, or essential features. In this biological opinion, we use the term PBF to mean PCE or essential feature, as appropriate for the specific critical habitat.

The 2019 regulations define effects of the action using the term "consequences" (50 CFR 402.02). As explained in the preamble to the regulations (84 FR 44977), that definition does not change the scope of our analysis and in this opinion we use the terms "effects" and "consequences" interchangeably.

2.2. Rangewide Status of the Species and Critical Habitat

This opinion examines the status of each species that would be adversely affected by the proposed action. The status is determined by the level of extinction risk that the listed species face, based on parameters considered in documents such as recovery plans, status reviews, and listing decisions. This informs the description of the species' likelihood of both survival and recovery. The species status section also helps to inform the description of the species' "reproduction, numbers, or distribution" as described in 50 CFR 402.02. The opinion also examines the condition of critical habitat throughout the designated area, evaluates the conservation value of the various watersheds and coastal and marine environments that make up the designated area, and discusses the function of the PBFs that are essential for the conservation of the species.

One factor affecting the status of ESA-listed species considered in this opinion, and aquatic habitat at large, is climate change. Climate change is likely to play an increasingly important role in determining the abundance and distribution of ESA-listed species, and the conservation value of designated critical habitats, in the Pacific Northwest. These changes will not be spatially homogeneous across the Pacific Northwest. The largest hydrologic responses are expected to occur in basins with significant snow accumulation, where warming decreases snow pack, increases winter flows, and advances the timing of spring melt (Mote *et al.* 2014, Mote *et al.* 2016). Rain-dominated watersheds and those with significant contributions from groundwater may be less sensitive to predicted changes in climate (Tague *et al.* 2013; Mote *et al.* 2014).

During the last century, average regional air temperatures in the Pacific Northwest increased by 1-1.4°F as an annual average, and up to 2°F in some seasons (based on average linear increase per decade; Abatzoglou *et al.* 2014; Kunkel *et al*. 2013). Warming is likely to continue during the next century as average temperatures are projected to increase another 3 to 10°F, with the largest increases predicted to occur in the summer (Mote *et al*. 2014).

Decreases in summer precipitation of as much as 30% by the end of the century are consistently predicted across climate models (Mote *et al.* 2014). Precipitation is more likely to occur during October through March, less during summer months, and more winter precipitation will be rain than snow (ISAB 2007; Mote *et al*. 2013). Earlier snowmelt will cause lower stream flows in late spring, summer, and fall, and water temperatures will be warmer (ISAB 2007; Mote *et al.* 2013). Models consistently predict increases in the frequency of severe winter precipitation events (i.e., 20-year and 50-year events), in the western United States (Dominguez *et al.* 2012). The largest increases in winter flood frequency and magnitude are predicted in mixed rain-snow watersheds (Mote *et al*. 2014).

Overall, about one-third of the current cold-water salmonid habitat in the Pacific Northwest is likely to exceed key water temperature thresholds by the end of this century (Mantua *et al*. 2009). Higher temperatures will reduce the quality of available salmonid habitat for most freshwater life stages (ISAB 2007). Reduced flows will make it more difficult for migrating fish to pass physical and thermal obstructions, limiting their access to available habitat (Mantua *et al.* 2010; Isaak *et al*. 2012). Temperature increases shift timing of key life cycle events for salmonids and species forming the base of their aquatic foodwebs (Crozier *et al.* 2011; Tillmann and Siemann 2011; Winder and Schindler 2004). Higher stream temperatures will also cause decreases in dissolved oxygen and may also cause earlier onset of stratification and reduced mixing between layers in lakes and reservoirs, which can also result in reduced oxygen (Meyer *et al*. 1999; Winder and Schindler 2004, Raymondi *et al.* 2013). Higher temperatures are likely to cause several species to become more susceptible to parasites, disease, and higher predation rates (Crozier *et al.* 2008; Wainwright and Weitkamp 2013; Raymondi *et al.* 2013).

As more basins become rain-dominated and prone to more severe winter storms, higher winter stream flows may increase the risk that winter or spring floods in sensitive watersheds will damage spawning redds and wash away incubating eggs (Goode *et al.* 2013). Earlier peak stream flows will also alter migration timing for salmon smolts, and may flush some young salmon and steelhead from rivers to estuaries before they are physically mature, increasing stress and reducing smolt survival (McMahon and Hartman 1989; Lawson *et al.* 2004).

In addition to changes in freshwater conditions, predicted changes for coastal waters in the Pacific Northwest because of climate change include increasing surface water temperature, increasing but highly variable acidity, and increasing storm frequency and magnitude (Mote *et al.* 2014). Elevated ocean temperatures already documented for the Pacific Northwest are highly likely to continue during the next century, with sea surface temperature projected to increase by 1.0-3.7 °C by the end of the century (IPCC 2014). Habitat loss, shifts in species' ranges and abundances, and altered marine food webs could have substantial consequences to anadromous, coastal, and marine species in the Pacific Northwest (Tillmann and Siemann 2011; Reeder *et al.* 2013).

Moreover, as atmospheric carbon emissions increase, increasing levels of carbon are absorbed by the oceans, changing the pH of the water. Acidification also impacts sensitive estuary habitats, where organic matter and nutrient inputs further reduce pH and produce conditions more corrosive than those in offshore waters (Feely *et al.* 2012, Sunda and Cai 2012).

Global sea levels are expected to continue rising throughout this century, reaching likely predicted increases of 10-32 inches by 2081-2100 (IPCC 2014). These changes will likely result in increased erosion and more frequent and severe coastal flooding, and shifts in the composition of nearshore habitats (Tillmann and Siemann 2011, Reeder *et al.* 2013). Estuarine-dependent salmonids such as chum and Chinook salmon are predicted to be impacted by significant reductions in rearing habitat in some Pacific Northwest coastal areas (Glick *et al.* 2007).

Historically, warm periods in the coastal Pacific Ocean have coincided with relatively low abundances of salmon and steelhead, while cooler ocean periods have coincided with relatively high abundances, and therefore these species are predicted to fare poorly in warming ocean conditions (Scheuerell and Williams 2005; Zabel *et al.* 2006). This is supported by the recent observation that anomalously warm sea surface temperatures off the coast of Washington from 2013 to 2016 resulted in poor coho and Chinook salmon body condition for juveniles caught in those waters (NWFSC 2015). Changes to estuarine and coastal conditions, as well as the timing of seasonal shifts in these habitats, have the potential to impact a wide range of listed aquatic species (Tillmann and Siemann 2011, Reeder *et al.* 2013).

The adaptive ability of these threatened and endangered species is depressed due to reductions in population size, habitat quantity and diversity, and loss of behavioral and genetic variation. Without these natural sources of resilience, systematic changes in local and regional climatic conditions due to anthropogenic global climate change will likely reduce long-term viability and sustainability of populations in many of these ESUs (NWFSC 2015). New stressors generated by climate change, or existing stressors with effects that have been amplified by climate change, may also have synergistic impacts on species and ecosystems (Doney *et al.* 2012). These conditions will possibly intensify the climate change stressors inhibiting recovery of ESA-listed species in the future.

2.2.1 Status of Critical Habitat

This section describes the status of designated critical habitat affected by the proposed action by examining the condition and trends of the essential physical and biological features of that habitat throughout the designated areas. These features are essential to the conservation of the ESA-listed species because they support one or more of the species' life stages (e.g., sites with conditions that support spawning, rearing, migration and foraging).

For most salmon and steelhead, NMFS's critical habitat analytical review teams (CHARTs) ranked watersheds within designated critical habitat at the scale of the fifth-field hydrologic unit code (HUC5) in terms of the conservation value they provide to each ESA-listed species that they support (NMFS 2005). The conservation rankings were high, medium, or low. To determine the conservation value of each watershed to species viability, the CHARTs evaluated the quantity and quality of habitat features, the relationship of the area compared to other areas within the species' range, and the significance to the species of the population occupying that area. Even if a location had poor habitat quality, it could be ranked with a high conservation value if it were essential due to factors such as limited availability, a unique contribution of the population it served, or is serving another important role.

For southern DPS green sturgeon, a team similar to the CHARTs — a critical habitat review team (CHRT) — identified and analyzed the conservation value of particular areas occupied by southern green sturgeon, and unoccupied areas necessary to ensure the conservation of the species (USDC 2009). The CHRT did not identify those particular areas using HUC nomenclature, but did provide geographic place names for those areas, including the names of freshwater rivers, the bypasses, the Sacramento-San Joaquin Delta, coastal bays and estuaries, and coastal marine areas (within 110 m depth) extending from the California/Mexico border north to Monterey Bay, California, and from the Alaska/Canada border northwest to the Bering Strait; and certain coastal bays and estuaries in California, Oregon, and Washington.

For southern DPS eulachon, critical habitat includes portions of 16 rivers and streams in California, Oregon, and Washington (USDC 2011). We designated all of these areas as migration and spawning habitat for this species.

A summary of the status of critical habitats, considered in this opinion, is provided in Table 4, below.

Table 4. Critical habitat, designation date, federal register citation, and status summary for critical habitat considered in this opinion.

Species	Designation Date and Federal Register Citation	Critical Habitat Status Summary
OC coho salmon	2/11/08 73 FR 7816	Critical habitat encompasses 13 subbasins in Oregon. The long-term decline in Oregon Coast coho salmon productivity reflects deteriorating conditions in freshwater habitat as well as extensive loss of access to habitats in estuaries and tidal freshwater. Many of the habitat changes resulting from land use practices over the last 150 years that contributed to the ESA-listing of Oregon Coast coho salmon continue to hinder recovery of the populations; changes in the watersheds due to land use practices have weakened natural watershed processes and functions, including loss of connectivity to historical floodplains, wetlands and side channels; reduced riparian area functions (stream temperature regulation, wood recruitment, sediment and nutrient retention); and altered flow and sediment regimes (NMFS 2016a). Several historical and ongoing land uses have reduced stream capacity and complexity in Oregon coastal streams and lakes through disturbance, road building, splash damming, stream cleaning, and other activities. Beaver removal, combined with loss of large wood in streams, has also led to degraded stream habitat conditions for coho salmon (Stout *et al.* 2012)
Southern DPS green sturgeon	10/09/09 74 FR 52300	Critical habitat has been designated in coastal U.S. marine waters within 60 fathoms depth from Monterey Bay, California (including Monterey Bay), north to Cape Flattery, Washington, including the Strait of Juan de Fuca, Washington, to its United States boundary; the Sacramento River, lower Feather River, and lower Yuba River in California; the Sacramento-San Joaquin Delta and Suisun, San Pablo, and San Francisco bays in California; tidally influenced areas of the Columbia River estuary from the mouth upstream to river mile 46; and certain coastal bays and estuaries in California (Humboldt Bay), Oregon (Coos Bay, Winchester Bay, Yaquina Bay, and Nehalem Bay), and Washington (Willapa Bay and Grays Harbor), including, but not limited to, areas upstream to the head of tide in various streams that drain into the bays. Several activities threaten the PBFs in coastal bays and estuaries and need special management considerations or protection. The application of pesticides, activities that disturb bottom substrates/ adversely affect prey resources/ degrade water quality through re-suspension of contaminated sediments, commercial shipping and activities that discharge contaminants and result in bioaccumulation of contaminants in green sturgeon; disposal of dredged materials that bury prey resources; and bottom trawl fisheries that disturb the bottom/prey resources for green sturgeon.
SONCC coho salmon	5/5/99 64 FR 57399	Critical habitat includes all areas accessible to any life-stage up to long-standing, natural barriers and adjacent riparian zones. SONCC coho salmon critical habitat within this geographic area has been degraded from historical conditions by ongoing land management activities. Habitat impairments recognized as factors leading to decline of the species that were included in the original listing notice for SONCC coho salmon include: 1) Channel morphology changes; 2) substrate changes; 3) loss of in-stream roughness; 4) loss of estuarine habitat; 5) loss of wetlands; 6) loss/degradation of riparian areas; 7) declines in water quality; 8) altered stream flows; 9) fish passage impediments; and 10) elimination of habitat

OC coho salmon critical habitat units

The fifth-field watersheds in Table 5 are the OC coho salmon critical habitat units that the proposed action will affect. The PBFs that support OC coho salmon growth and survival in these critical habitat units include forage, free of artificial obstruction, natural cover, salinity, water quality, and water quantity. The OC coho salmon CHART rated each critical habitat unit with a conservation value of high, medium, or low based on the importance of each critical habitat unit for supporting successful production of OC coho salmon.

Table 5. The OC coho salmon critical habitat units affected by the proposed action with and their respective conservation value ratings.

Project estuary	Watershed name	HUC5	Conservation value
Tillamook Bay	Tillamook Bay – Frontal Pacific Ocean	1710020308	High
Depoe Bay	Rock Creek – Frontal Pacific Ocean	1710020409	Medium
Yaquina Bay	Lower Yaquina River	1710020403	High
Siuslaw River	Lower Siuslaw River	1710020608	High
Umpqua River	Lower Umpqua River	1710030308	High
Coos Bay	Coos Bay – Frontal Pacific Ocean	1710030403	High
Coquille River	Coquille River	1710030505	High

Southern DPS green sturgeon critical units

The fifth-field watersheds in Table 6 are the green sturgeon critical habitat units that the proposed action will affect. The PBFs that support green sturgeon growth and survival in these critical habitat units include food resources, migratory corridor, sediment quality, water flow, water depth, and water quality.

Table 6. The green sturgeon critical habitat units affected by this proposed action.

Project estuary	Watershed name	HUC5
Yaquina Bay	Lower Yaquina River	1710020403
Umpqua River	Lower Umpqua River	1710030308
Coos Bay	Coos Bay - Frontal Pacific Ocean	1710030403

SONCC coho salmon critical habitat units

The Rogue River (1710031008) and Chetco River (1710031201) fifth-field watersheds are the SONCC coho salmon critical habitat units that the proposed action will affect. The PBFs that support SONCC coho salmon growth and survival in these critical habitat units include cover/shelter, food, riparian vegetation, safe passage, space, substrate, water quality, water quantity, water temperature, and water velocity.

2.2.2 Status of Species

Table 7, below provides a summary of listing and recovery plan information, status summaries and limiting factors for the species addressed in this opinion. More information can be found in recovery plans and status reviews for these species. Acronyms appearing in the table include DPS (Distinct Population Segment), ESU (Evolutionarily Significant Unit), ICTRT (Interior Columbia Technical Recovery Team), MPG (Multiple Population Grouping), NWFSC (Northwest Fisheries Science Center), TRT (Technical Recovery Team), and VSP (Viable Salmonid Population).

Table 7. Listing classification and date, recovery plan reference, most recent status review, status summary, and limiting factors for each species considered in this opinion.

Species	Listing classification and date	Recovery plan reference	Most recent status review	Status summary	Limiting Factors
OC coho salmon	Threatened 6/20/11; Reaffirmed 4/14/14	NMFS 2016	NWFSC 2015	This ESU comprises 56 populations including 21 independent and 35 dependent populations. The last status review indicated a moderate risk of extinction. Significant improvements in hatchery and harvest practices have been made for this ESU. Most recently, spatial structure conditions have improved in terms of spawner and juvenile distribution in watersheds; none of the geographic area or strata within the ESU appear to have considerably lower abundance or productivity. The ability of the ESU to survive another prolonged period of poor marine survival remains in question.	• Reduced amount and complexity of habitat including connected floodplain habitat • Degraded water quality • Blocked/impaired fish passage • Inadequate long-term habitat protection • Changes in ocean conditions
Southern DPS green sturgeon	Threatened 4/7/06	NMFS 2018	NMFS 2015	The Sacramento River contains the only known green sturgeon spawning population in this DPS. The current estimate of spawning adult abundance is between 824-1,872 individuals. Telemetry data and genetic analyses suggest that Southern DPS green sturgeon generally occur from Graves Harbor, Alaska to Monterey Bay, California and, within this range, most frequently occur in coastal waters of Washington, Oregon, and Vancouver Island and near San Francisco and Monterey bays. Within the nearshore marine environment, tagging and fisheries data indicate that Northern and Southern DPS green sturgeon prefer marine waters of less than a depth of 110 meters.	• Reduction of its spawning area to a single known population • Lack of water quantity • Poor water quality • Poaching
SONCC coho salmon	Threatened 6/28/05	NMFS 2014	NWFSC 2015	This ESU comprises 31 independent, 9 independent, and 5 ephemeral populations all grouped into 7 diversity strata. Of the 31 independent populations, 24 are at high risk of extinction and 6 are at moderate risk of extinction. The extinction risk of an ESU depends upon the extinction risk of its constituent independent populations; because the population abundance of most independent populations are below their depensation threshold, the SONCC coho salmon ESU is at high risk of extinction and is not viable	• Lack of floodplain and channel structure • Impaired water quality • Altered hydrologic function • Impaired estuary/mainstem function • Degraded riparian forest conditions • Altered sediment supply • Increased disease/predation/competition • Barriers to migration • Fishery-related effects • Hatchery-related effects

Population trends

OC coho salmon. The specific populations of OC coho salmon affected by the project include the Tillamook, Yaquina, Siuslaw, Lower Umpqua, Middle Umpqua, North Umpqua, South Umpqua, Coos and Coquille River populations (Figure 18). The abundance of these populations of OC coho salmon have shown a high degree of fluctuation over the last 10 years. Fluctuation in population abundance occurs for many reasons including changes in land use, changing climate conditions, and changes in ocean conditions.

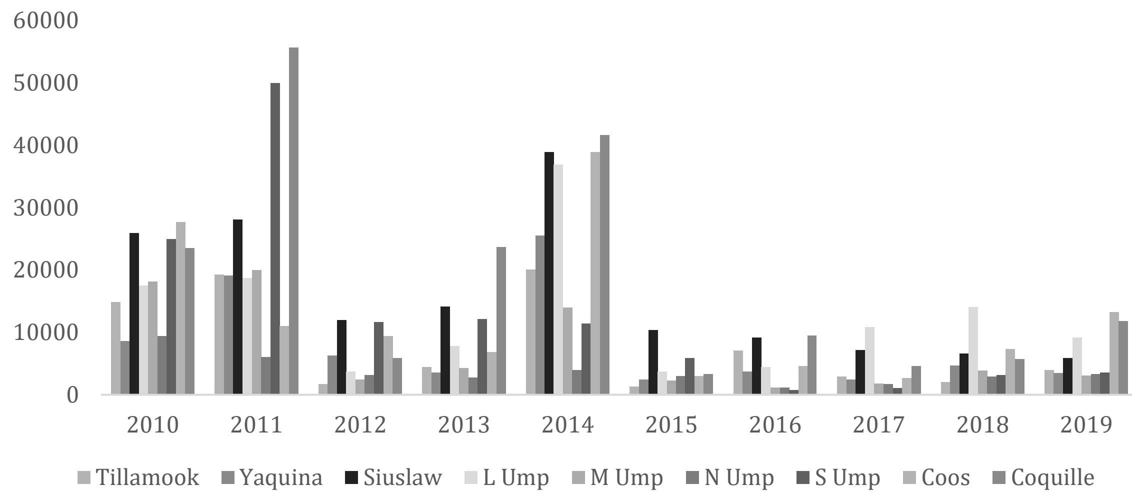

Figure 18. Population abundance for the OC coho salmon populations affected by the proposed action from 2010 to 2019.

During the most recent status review, NWFSC (2015) reported the population persistence truth values to indicate complete confidence that the OC coho salmon populations would persist for the next 100 years, certainty of failure to persist, or no certainty of either persistence or extinction. Table 8 describes the certainty of persistence for the affected populations of OC coho salmon.

Table 8. Certainty of persistence for the populations of OC coho salmon affected by the proposed action. For the North Umpqua, the BRT score was negative indicating moderate certainty the population would persist for the next 100 years.

Population	Certainty of persistence
Tillamook	Moderate
Yaquina	High
Siuslaw	High
Lower Umpqua	High
Middle Umpqua	Moderate
North Umpqua	Moderate
South Umpqua	High
Coos	High
Coquille	High

Green sturgeon. Relatively large numbers of green sturgeon seasonally utilize the Coos, Winchester (Umpqua River estuary), Yaquina, and Nehalem bays in Oregon (NMFS 2018) although number estimates of individuals are currently unknown. It is also difficult to ascertain abundance levels in the ocean. However, as presented in NMFS 2018, the most useful dataset for examining population trends comes from Dual Frequency Identification Sonar (DIDSON) surveys in the Sacramento River, which began in 2010. These surveys have been used to estimate the abundance of southern DPS green sturgeon adults at 2,106 individuals (95% confidence interval [CI] = 1,246-2,966; Mora 2016; Mora *et al.* 2018). A conceptual demographic structure applied to that adult population estimate resulted in a southern DPS subadult population estimate of 11,055 (95% CI = 6,540-15,571) (Mora *et al.* 2018). The DIDSON surveys and associated modeling will eventually provide population trend data. Other efforts to track population trends are underway using tagging and fisheries data and larval capture as reviewed in Heublein *et al.* (2017a). Green sturgeon are also likely to occur in the Rogue River, Siuslaw River, and Tillamook Bay estuaries (74 FR 52300).

SONCC coho salmon. The specific populations of SONCC coho salmon affected by the proposed action include the Elk, Lower Rogue, Middle Rogue/Applegate, Illinois, Upper Rogue, and Chetco River populations. The abundance of these populations of SONCC coho salmon has not been well documented over the years. For the Rogue River populations the best data are from the Huntley Park seine estimates of naturally produced coho salmon spawner abundance in the Rogue River basin, incorporating all four populations (Figure 19). The Huntley Park data have a significant positive trend ($p = 0.01$) over the past 35 years and a non-significant negative trend ($p > 0.05$) from 2004 to 2015 (Williams 2016). From 2016 to 2019, the population estimates from Huntley Park have been variable at 6,302, 4,526, 8,266, and 2,156, respectively. However, it is impossible to determine, with existing information, how many of the estimated coho salmon at Huntley Park are returning to an area occupied by a specific Rogue River population.

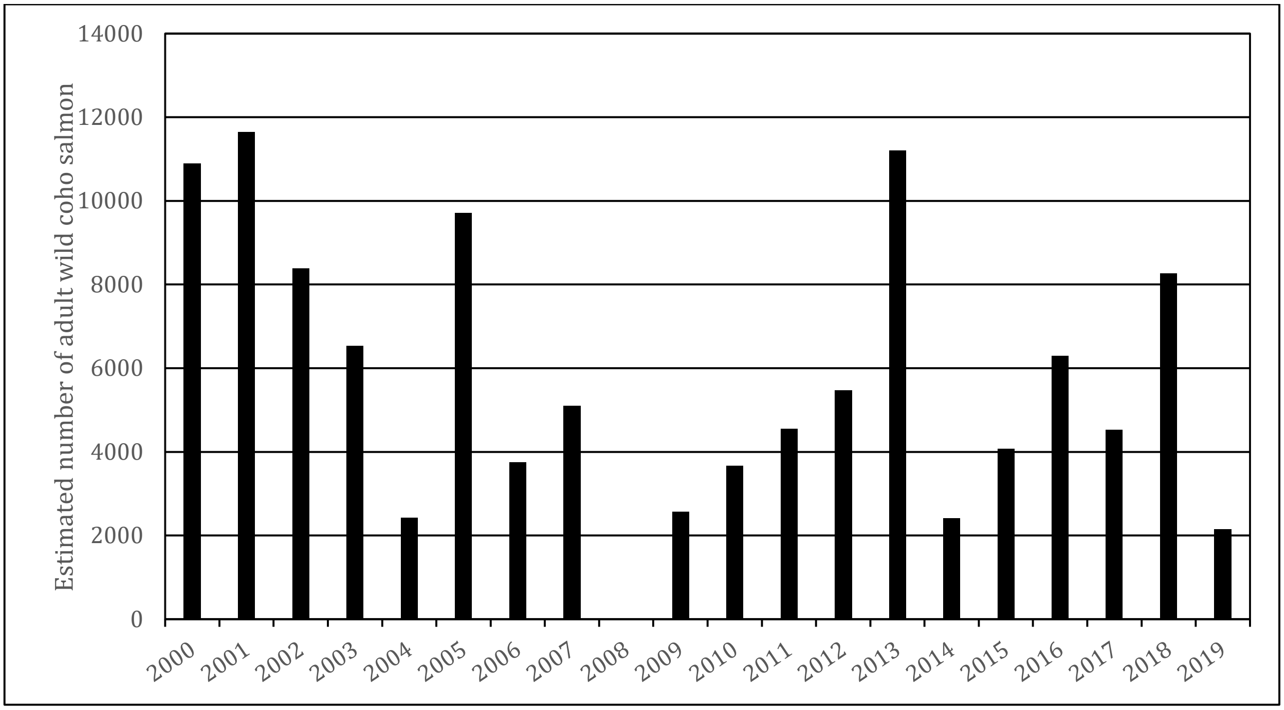

Figure 19. Estimated number of wild adult coho salmon in the Rogue River basin (Huntley Park sampling), 2000 to 2019.[2]

The ODFW also conducted adult coho salmon spawning surveys for the Upper Rogue River, Middle Rogue/Applegate River, and the Illinois River, beginning in 2002 (Tables 9 – 11). Data were not collected in 2005 or in 2009-2019, which complicates efforts to track the strength of year classes. Additionally, for the Lower Rogue River, ODFW estimated a maximum wild coho salmon escapement of 235 during the period of 1998 to 2012 (Table 12). Adult spawner escapement estimates for the Elk River from 1998-2007 are listed in Table 13, although in many years estimated returns were zero (NMFS 2014). The ODFW did not survey the Chetco River for coho salmon.

[2] 2008 data were excluded from consideration because the extremely low numbers were not consistent with that seen upstream at Gold Ray Dam, suggesting other reasons (sampling issues, data errors, etc.) for the dramatic drop in fish numbers from 2007 to 2008.

Table 9. Illinois River subbasin coho salmon spawning surveys for 2002-2019[3] and estimated number of wild spawners.

Year	Number of surveys	Number of mile surveyed miles	Wild estimated spawners	95% Confidence Interval
2002	15	13	1316	630
2003	13	11.7	1574	987
2004	9	7.5	3837	2305
2005			No surveys	
2006	3	2.7	1031	1777
2007	4	3.8	2117	1301
2008	3	2.7	745	787
2009			No surveys	
2010			No surveys	
2011			No surveys	
2012			No surveys	
2013			No surveys	
2014			No surveys	
2015			No surveys	
2016			No surveys	
2017			No surveys	
2018			No surveys	
			No surveys	

3 Data from ODFW available online at: http://oregonstate.edu/dept/ODFW/spawn/pdf%20files/coho/2002-12FinalSONCCEstimates.pdf (Last Accessed April 2021).

Table 10. Middle Rogue/Applegate River subbasin coho salmon spawning surveys for 2002-2014 and estimated number of wild spawners.

Year	Number of surveys	Number of mile surveyed miles	Wild estimated spawners	95% Confidence Interval
2002	16	14.8	792	605
2003	21	17.3	142	91
2004	24	21.3	2695	1195
2005	No surveys			
2006	8	9.1	No data	N/A
2007	11	10	1930	479
2008	16	12.7	459	291
2009	No surveys			
2010	No surveys			
2011	No surveys			
2012	No surveys			
2013	No surveys			
2014	No surveys			
2015	No surveys			
2016	No surveys			
2017	No surveys			
2018	No surveys			
2019	No surveys			

Table 11. Upper Rogue River subbasin coho salmon spawning surveys for 2002-2014[21] and estimated number of wild spawners.

Year	Number of surveys	Number of mile surveyed miles	Wild estimated spawners	95% Confidence Interval
2002	18	17.3	2929	1911
2003	22	21.4	1350	434
2004	18	18.5	2580	1388
2005		No surveys		
2006	14	13.1	319	179
2007	7	6.9	No data	N/A
2008	5	5.3	No data	N/A
2009		No surveys		
2010		No surveys		
2011		No surveys		
2012		No surveys		
2013		No surveys		
2014		No surveys		
2015		No surveys		
2016		No surveys		
2017		No surveys		
2018		No surveys		
2019		No surveys		

Table 12. Estimates of annual spawning escapement of wild coho salmon for the Lower Rogue River (NMFS 2014).

Year	Population Estimate
1998	0
1999	0
2000	59
2001	235
2002	205
2003	75
2004	127
2005	127
2006	35
2007	193
2008	184
2009	193
2010	0
2011	44
2012	0

Table 13. Estimates of annual spawning escapement of wild coho salmon for Elk River (NMFS 2014).

Year	Population Estimate
1998	501
1999	Not estimate
2000	0
2001	Not estimated
2002	104
2003	187
2004	0
2005	0
2006	0
2007	230
2008	Not estimated

For the Chetco River population, the only available data on coho salmon spawner returns comes from the ODFW Chinook salmon spawning surveys (1998-2012) which occasionally document coho salmon.[4] The ODFW estimates coho salmon annual returns based on these surveys, but the reliability and utility of the data and the associated estimates is low because, the surveys did not target coho salmon, their geographic scope misses a lot of the coho spawning grounds, and coho salmon spawning may not occur at the same times as that of Chinook salmon (NMFS 2014).[5] The average of ODFW's annual estimates of adult returns is 148 adult coho salmon. In light of the poor reliability of the data and to give the benefit of doubt to the species, we assume the actual population is below this level.

Little information is available for juvenile coho salmon abundance in the Chetco River, as well. Juveniles were found at only three locations and at very low densities within the basin during snorkeling surveys conducted in 2003 and 2004 (Jepsen and Rodgers 2004; Jepsen 2006). In a trapping operation on Jack Creek between March 9 and May 10, 2007; ODFW captured 69 out-migrant coho salmon smolts. Operation of this trap between March 13 and May 16, 2008 caught 163 coho salmon smolts. The trap did not provide enough data for ODFW to make estimates of the total outmigration for either year, but due to inefficiencies in trapping (Newcomb and Coon 2001) it is likely four to five times the number caught. In addition, low water levels stopped the trap in mid-May, while the coho salmon smolt outmigration likely lasts to mid-June.

[4] E-mail from Todd Confer, Oregon Department of Fish and Wildlife, to Chuck Wheeler, NMFS (June 10, 2013) (attaching Rogue Watershed District estimates of annual spawning escapement of coho salmon spawning in the coastal strata of the Oregon portion of the SONCC coho salmon recovery domain, 1998-2012).

[5] In years where estimates are zero, the Chinook salmon surveyors either did not see any coho salmon, did not distinguish the difference between Chinook salmon and coho salmon, or did not mark them down as they were not the target of their work. It is highly unlikely that the actual number of spawners in those years was zero because adults returned three or six years later (indicating successful spawning the year in which a zero was recorded).

2.3. Action Area

"Action area" means all areas to be affected directly or indirectly by the Federal action and not merely the immediate area involved in the action (50 CFR 402.02). The action area for this proposed action consists of all Federally-authorized navigation channels, the AMD gravel bar at the Rogue River, ocean disposal sites, and transit routes to the disposal sites. This includes the water column and substrate in the project estuaries and their associated in-river and ocean disposal sites, a 100-foot area (200-foot area for finer-grained when finer-grained sediments are present) on each side of and down current of the dredging and in-river/bay/estuary disposal activity sites to account for suspended sediment drift. The action area also includes up to 500 feet outside the boundaries of the individual ODMDSs to account for drift of suspended sediments related to disposed dredged materials.

2.4. Environmental Baseline

The "environmental baseline" refers to the condition of the listed species or its designated critical habitat in the action area, without the consequences to the listed species or designated critical habitat caused by the proposed action. The environmental baseline includes the past and present impacts of all Federal, State, or private actions and other human activities in the action area, the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultations, and the impact of State or private actions which are contemporaneous with the consultation in process. The consequences to listed species or designated critical habitat from ongoing agency activities or existing agency facilities that are not within the agency's discretion to modify are part of the environmental baseline (50 CFR 402.02).

The climate change effects on the environmental baseline are described in Section 2.2, above. Climate change is likely to play an increasingly important role in determining the abundance of OC coho salmon and UWR steelhead and the conservation value of designated critical habitats.

Since the 2017 opinion, NMFS has engaged in section 7 consultation on Federal projects affecting the effected populations and their habitats in the action area and those impacts have been taken into account in this opinion. These consultations include implementation of the Standard Local Operating Procedures for Endangered Species (SLOPES) stormwater, transportation, and utilities; in-water and over-water structures; and restoration programmatic biological opinions, licensing of the PacWave South Wave Energy Test Site, the Jordan Cove LNG Export Terminal and Pacific Connector Pipeline Project, and others.

2.4.1 Estuarine Action Area

Key management activities that occur or have occurred in and upstream of the estuarine action area have degraded aquatic habitats in the project estuaries. Key management activities of the action area include agriculture, forestry, grazing, road building and maintenance, urbanization, and gravel mining (Table 14). Key management activities have degraded water and sediment quality, habitat complexity and functionality, high quality habitat and habitat availability, and forage abundance and quality. Specific activities related to the key management activities that have contributed to this degradation include dredging, construction of in-water and over-water structures, discharge of stormwater associated with impervious surfaces, discharge of industrial and municipal wastewater effluent, estuarine fill, streambank armoring and stabilization, and construction of dikes and levees.

Table 14. Key management activities in or upstream of the action area that are affecting the action area.

Project Estuary	Key management activities
Tillamook Bay	Agriculture, forestry, grazing, roads, and urbanization
Depoe Bay	Forestry, grazing, and urbanization
Yaquina Bay	Agriculture, forestry, grazing, roads, and urbanization
Siuslaw River	Forestry, grazing, and urbanization
Umpqua River	Forestry, grazing, and urbanization
Coos Bay	Forestry, grazing, and urbanization
Coquille River	Agriculture, forestry, and urbanization
Port Orford	Urbanization
Rogue River	Agriculture, forestry, roads, urbanization, gravel mining
Chetco River	Agriculture, forestry, roads, urbanization, gravel mining

The Corps has routinely (approximately every 5 years) conducted sediment testing to ensure sediment quality is clean enough that it may be mobilized in the water column without resulting in adverse impacts to aquatic habitat or species. The Corps follows the procedures in the SEF for the Pacific Northwest (RSET 2016) for assessing, characterizing, and managing (disposing) sediments and determining suitability for unconfined in-water placement. The testing results have shown that most of the dredged sediments in the Corps Oregon Coastal projects are suitable for unconfined in-water placement (Table 15).

Table 15. Summary of sediment analysis results for the Corps Oregon Coastal navigation projects.

Sampling location	Most recent sampling	Sediment Composition	Sampling results
Tillamook Bay	8/22/2007 (09/2014*)	48% sand, 50% fines, 1.7% gravel	Material suitable for unconfined in-water placement
Depoe Bay Boat Basin	7/27/2010 (7/2015*)	60% sand, 40% fines, <1% gravel	Material suitable for unconfined in-water placement
Depoe Bay behind check dam	7/27/2010 (7/2015*)	65% sand, 32% fines, 3% gravel	Material suitable for unconfined in-water placement
Yaquina River main channel	7/28/2010 (7/2015*)	94% sand, 6% fines	Material suitable for unconfined in-water placement
Yaquina River South Beach	7/28/2010 (7/2015*)	45% sand, 55% fines, <1% gravel	Material suitable for unconfined in-water placement
Siuslaw entrance/nav. Channel	9/1/2011	97% sand, 3% fines, 0.0% gravel	Material suitable for unconfined in-water placement
Siuslaw turning basin	9/1/2011	97% sand, 3% fines, 0.0% gravel	Material suitable for unconfined in-water placement

Sampling location	Most recent sampling	Sediment Composition	Sampling results
Umpqua (main channel, Winchester Bay, Gardiner channel	8/31/2011	FNC: 97.2% sand, 2.6% fines Winchester Bay: 19.8% sand, 79.3% fines Gardiner: 89.6% sand, 10.4% fines	Material suitable for unconfined in-water placement
Coos Bay main channel	9/16/2009 (7/2014*)	86% sand, 14% fines	Material suitable for unconfined in-water placement
Coos Bay Charleston channel	9/16/2009 (7/2014*)	99% sand, 11% fines	Material suitable for unconfined in-water placement
Coos Bay Isthmus Slough	9/16/2009 (7/2014*)	10% sand, 90% fines	Material suitable for unconfined in-water placement
Coquille River main channel	8/30/2011	84% sand, 2% fines, 14% gravel	Material suitable for unconfined in-water placement
	4/25/2014	Visual observation of fine and coarse sands, gravel, and shell hash	Material suitable for unconfined in-water placement
Coquille River boat basin access channel	8/30/2011	20% sand, 80% fines	Material suitable for unconfined in-water placement
	4/25/2014	Visual observation of fine sand, silt, and clay	Material suitable for unconfined in-water placement
Port Orford turning basin	8/6/2007 (7/2014*)	95% sand, 5% fines, 1% gravel	Material suitable for unconfined in-water placement
Rogue River nav. channel	9/18/2012	45% gravel, 53% sand, <1% fines	Material suitable for unconfined in-water placement
Rogue River boat basin access channel	9/18/2012	34% gravel, 37% sand, 26% fines	Phenol at 1,800 ug/kg; won't be dredged without further characterization
Rogue River boat basin access outer portion, coarse grain	5/4/2015	Visual observation of gravels, cobbles, and sands	Material suitable for unconfined in-water placement
Rogue River boat basin access inner portion, fine-grained	7/21/2014*	1% gravel, 50% sand, 49% fines	Phenol at 640 ug/kg, 4-methyphenol at 1,500 ug/kg, multiple one-hit bioassay failures; fined-grained materials in the inner portion of access channel are unsuitable for unconfined in-water placement
	5/4/2015	Visual observation of small gravels, sands, and fines/muck	Fined-grained materials in the inner portion of access channel are unsuitable for unconfined in-water placement
Chetco River nav. channel and boat basin	6/9/2011	49% sand, 6% silt/clay, 45% gravel (varied widely by location)	2, 4-dimethylphenol MRL slightly above screening level (sample result was ND); suitable for unconfined in-water placement

2.4.2 Coastal Marine Action Area

The action area includes the ODMDS's in the coastal marine area of the Pacific Ocean, in which the ODMDS's for the Depoe Bay, Yaquina, Siuslaw, Umpqua, Coos Bay, Coquille, Port Orford, Rogue, and Chetco projects are located. The coastal marine area is only designated critical habitat for green sturgeon, but this marine habitat is also essential for the growth and development and thus the survival and fitness of individual OC and SONCC coho salmon. The coastal marine action area is indicative of a dynamic nearshore ecological zone that naturally would be characterized by a disturbance-based benthic ecosystem. The environmental baseline in the coastal marine action area has been degraded by past human uses, such as commercial and recreational fishing, oceanographic research and monitoring, and commercial and recreational vessel traffic.

Biotic community

Studies along the coast have demonstrated summer chlorophyll a (chl) concentration is relative to winter river outflow and continental shelf widths (Chase *et al.* 2007). The winter river flows carry iron into the ocean which summer upwelling later brings back to the shallows, thus fueling phytoplankton production. Chase *et al*. (2007) presented chl concentrations from the sea-viewing-wide-field-of-sensor (SeaWiFS) satellite data and the study area included this action area. Based on this SeaWiFS data presented in Chase *et al.* (2007), chl concentrations are likely moderately high in a narrow bandwidth along the Oregon Coast nearshore. The action area chl concentrations from this satellite data presentation appear comparable to other northern waters. The influence of the Pacific Ocean tributaries that are the focus of this proposed action and the subsequent ocean upwelling that bring the iron-rich nutrients back into the shallower water provide the basis for a rich phytoplankton community. Surface water chl concentrations along the West Coast shelf ranged from 0 to 28 micrograms per liter (µg/L). The 50th percentile of area sampled had a chl concentration of 3.9 µg/L, while the 90th percentile had a chl concentration of 14.5 µg/L. These values represent data from the 2003 sampling of 187 stations from California, Oregon, and Washington collected during a cruise to assess ecological conditions along the West Coast shelf (Nelson *et al.* 2008).

Bi *et al.* (2008) used increasing concentrations of chl as an indicator of primary production coupled with decreasing water depths to classify yearling coho salmon habitat quality. In their 2007 study (Bi *et al*. 2007), the foundation of their 2008 paper, they relied on low-zero catch probability as an indicator of habitat use; that is, they used fish sampling data and the presence or absence of yearling coho salmon to indicate habitat use and preferred quality. Given habitat use, they used step-wise regression to assess habitat condition indicators. The probability of having a zero-catch (of yearling coho salmon) decreased with increasing chl concentration and decreasing water depth. Based on the Chase *et al.* (2007) chl data presentation, the action area has comparable chl concentrations to the more northern Oregon and to a limited degree the Washington waters. In general chl concentrations are likely lower and less widely distributed than the areas off the Washington coast (Bi *et al.* 2008). Additional environmental factors, yet not understood, also determine yearling coho salmon abundance (Bi *et al* 2008).

Bi *et al.* (2008) characterized yearling coho salmon habitat as favorable, potentially favorable, or unfavorable based on the water depth, chl, and coho yearling abundance. Based on combining predictive habitat modeling and yearling coho salmon sampling data the researchers classified these habitats and presented abundance estimates. Large variability exists with these data and the subsequent abundance estimates. Year to year variation in predicting the location of these three habitat categories also varies significantly (Bi *et al.* 2008). It is likely the action area is favorable or potentially favorable habitat based on the water depth and chl concentrations, but the habitat quality will vary from year to year as observed with these studies. Some years the action area may even be unfavorable depending on the upwelling.

EPA (2008b) acknowledged no site specific information exists for zooplankton, the next level in the food web to help characterize coho salmon habitat quality, but suggest the similar oceanographic conditions exist along the coastal marine action area as near Newport, Oregon. However, Keister and Peterson (2003) provided a discussion of the zooplankton community found off the central Oregon Coast (along the Newport hydrographic line). For the coastal marine action area, it is likely that zooplankton population dynamics would be similar to those found in the Newport area because of similar oceanographic conditions.

Keister and Peterson (2003) provided a discussion of the zooplankton community found off the central Oregon Coast (along the Newport hydrographic line). They indicate in their study that seasonal variations in wind and current patterns strongly influence the zooplankton community. During late spring and summer, northwesterly winds set up equatorward flow and coastal upwelling. Northwesterly winds dominate from April/May-September where periodic relaxations or southwesterly storms rapidly affect the hydrography of nearshore areas. Offshore, about 19 miles, conditions are less variable. Boreal neritic copepods such as Pseudocalanus mimus, Calanus marshallae, Centropages abdominalis, Acartia longiremis, and Acartia hudsonica dominate the coastal plankton during summer (Peterson and Miller 1977). In early fall, winds reverse and upwelling ceases; during autumn and winter, winds are predominantly southwesterly, the Davidson Current flows poleward, and offshore surface waters are transported onshore. In winter, the coastal zooplankton is populated by warm-water species such as Mesocalanus tenuicornis, Paracalanus parvus, Ctenocalanus vanus, Clausocalanus spp., Acartia tonsa, and Corycaeus anglicus (Peterson and Miller 1977). The action area is within the continental shelf depths, so we will assume the area is productive yearling coho salmon and adult and sub-adult green sturgeon habitat when ocean conditions are optimal.

Field sampling conducted in 2008 near the Yaquina (EPA 2011) ODMDS's, in 2007 near the Umpqua (EPA 2008a) ODMDS's, and in 2007 near the Rogue (EPA 2008b) ODMDS's provides current information regarding the assemblage of benthic invertebrate fauna in the coastal marine action area. Species throughout the coastal marine action area included gammaridean amphipods, polychaete annelids, gastropods, cumaceans, crustaceans, cirripedians, and echinoderms.

Demersal fish and epibenthic species captured near the Umpqua and Yaquina ODMDS's included several commercially important species such as sole, flounder, lingcod, and Dungeness crab (EPA 2008b and EPA 2011). The trawl samples denote the nearshore area as a nursery ground with an abundant food source. Most of the species encountered in the trawl samples were benthic feeders that tend to utilize the shallower waters, where there tends to be abundant food and fewer predators. The majority of the fish and crabs captured in the trawls were juveniles and young-of-the-year. However, larger crabs and fish have the ability to avoid the trawl net and so may have been under-represented in the species captured.

The action area is within the nearshore area of the Pacific Ocean. The action area supports anadromous salmonids including coho salmon and green sturgeon as well as a variety of other pelagic and demersal fish species. Based on available information regarding general water quality conditions, water depths, and primary and secondary production, the baseline conditions of the action area provide, at a minimum, sufficient conditions to support coho salmon. The habitat quality of these conditions varies from year to year depending on the large scale ocean dynamics that determine nutrient upwelling and water quality conditions. Far fewer studies have occurred to link ocean conditions with marine survival, growth and production of green sturgeon, therefore it is assumed factors influencing these parameters are based on large-scale forces.

Sediments

EPA (2008a), EPA (2008b), and EPA and Corps (2011) discuss physical and chemical analyses of sediments from the ODMDS's at the Umpqua, Rogue, and Yaquina projects. Sediments from each location primarily consisted of sands, which is likely the case for the rest of the coastal marine action area. Other substrate types that the EPA and Corps identified in the action area included fine silt and clay, shell debris, gravels and rocky outcrops. Sediment contaminants identified in the chemical analyses included metals, pesticides, polychlorinated biphenyls (PCB), phenols, phthalates, extractables, and polycyclic aromatic hydrocarbons (PAHs), were below the established SEF screening levels.

Water quality

EPA (2008b) and EPA (2011) reported that water quality throughout the action area is typical for Oregon nearshore marine waters. Water column chemistry and physical characteristics offshore of the Oregon Coast were studied in 1980 (Fuhrer and Rinella 1982). All parameters measured were well within normal ranges expected for nearshore ocean waters and met the state's water quality standards. Specific information pertaining to total suspended solids (TSS) was not provided in the BA. Typical TSS values in waters of the West Coast shelf ranged from 0 to 10 milligrams per liter (mg/l) with the 50th percentile of 4.0 mg/l. These values represent data from the 2003 sampling of 137 stations from California, Oregon, and Washington collected during an ecological condition cruise (Nelson *et al.* 2008).

2.4.3 Critical Habitat in the Action Area

OC coho salmon critical habitat

The PBFs of OC coho salmon critical habitat in the action area include forage, natural cover, water quality, water quantity, fish passage free of obstruction, and salinity.

Forage. The estuarine portion of the action area is occupied by numerous species of marine invertebrates and marine fishes including mysids, amphipods, copepods, and various life stages of bottom fish and pelagic forage fish. Myers (1980) documented that coho salmon forage both in nearshore and deep subtidal habitats. Coho salmon in the estuary are known to feed on invertebrates and fish including decapod larvae, euphasiids, gammarid amphipods, and fish larvae (Simenstad 1983; Miller and Simenstad 1997; Magnusson and Hilborn 2003). Myers 1979 found that juvenile coho salmon in Yaquina Bay consumed juvenile anchovy (*Engraulis mordax*), surf smelt (*Hypomesus pretiosus*), and sand lance (*Ammodytes hexapterus);* crangonid shrimp; and megalopa larvae of Dungeness crab (*Cancer magister*). Many of these species' various life stages (*i.e.* adults, juveniles, larvae) are likely present in and use the substrate and water column in the estuarine action area for rearing and reproduction. Abundance and quality of OC coho salmon forage species has likely been adversely affected by reduction and degradation of available habitat caused by urbanization (*i.e.*, estuarine fill, municipal wastewater and stormwater discharges), dredging, and road related stormwater discharge.

Natural cover. Natural processes and urbanization that have occurred in the estuarine action area adversely affect this PBF. Shoreline development and road building has resulted in the halting of natural processes (erosion, lateral migration, sedimentation, vegetation development) that contribute to the creation of complex habitats that OC coho salmon use for resting, feeding, and predator avoidance. The halting of these natural processes has reduced quality and function of natural cover in the action area.

Water quality. Agriculture, road building and maintenance, urbanization, forestry, and climate change have adversely affected water quality in the estuarine action areas. Agriculture, forestry, and climate change have led to increased water temperatures and dissolved oxygen in several of the estuarine action areas. Eight of the estuaries in the action area are on Oregon Department of Environmental Quality's 303(d) list for water quality limited water bodies, three of which are listed for temperature or dissolved oxygen (Yaquina only). Six of these are in the rangewide distribution of OC coho salmon (Table 16). Stormwater and wastewater inputs associated with urbanization have also contributed to degraded water quality in the action area.

Table 16. 303(d) listed estuaries in the Corps' coastal dredging action area overlapping with OC coho salmon designated critical habitat. TMDL – Total Maximum Daily Load.

Project name	Water quality parameter	River mile	Status
Tillamook Bay	Fecal Coliform	0 - 7.2	Cat 4A
Yaquina Bay and River	Dissolved Oxygen	0 - 56.8	Cat 5
	Fecal Coliform	0 - 15.5	Cat 5
	Temperature	0 - 57.5	Cat 5
Siuslaw River	Biological Criteria	0 - 58.4	Cat 5
	Temperature	0 - 106	Cat 5
Umpqua River	Fecal Coliform	0 - 25.9	Cat 4A
	Temperature	0 - 100.2	Cat 4A
Coos Bay	Fecal Coliform	0 - 7.8	Cat 5
Coquille	Fecal Coliform	0 - 4.2	Cat 5

Cat 4A - TMDL approved – TMDL's needed to attain applicable water quality standards have been approved.
Cat 5 - Water is water quality limited and a TMDL is needed, Section 303(d) list.

Water quantity. Water withdrawals are likely affecting this PBF, but the effects on water quantity are not likely adverse as water quantity is largely impacted by tidal influence in the estuarine action area.

Salinity. Salinities in the estuaries range from low to high depending on the location in which dredging activities will occur. The highest salinities are likely lower in the estuaries near the entrance channels with the lowest salinities occurring at the upper extent of the Corps' navigation channel dredging action area in the project estuaries.

Fish passage free of obstruction. Physical, chemical, or biological barriers that would impede or delay passage of adult and juvenile OC coho salmon to access feeding areas, holding areas, and thermal refugia and ensure passage back out to the ocean do not occur in the action area.

SONCC coho salmon critical habitat

The PBFs of SONCC coho salmon critical habitat include cover/shelter, food, riparian vegetation, safe passage, space, substrate, water quality, water quantity, water temperature, and water velocity. The Rogue River and Chetco River estuaries are designated critical habitat for SONCC coho salmon.

Cover/shelter. See discussion of natural cover PBF for OC coho salmon above. Degradation of natural processes and urbanization and road development has reduced the quality and function of this PBF in the action area for SONCC coho salmon.

Food. See discussion of forage PBF for OC coho salmon above. The food PBF for SONCC coho salmon in the Rogue and Chetco River estuaries has likely been adversely affected by reduction and degradation of available habitat for prey organism by urbanization (*i.e.*, estuarine fill, municipal wastewater and stormwater discharges), dredging, and road related stormwater discharge. Additionally, in the inner portion of the Rogue River boat basin access channel, the sediments have been determined by the PSET as unsuitable for unconfined in-water placement (see discussion of substrate PBF below). This has likely resulted in a reduction of food quality in a portion of the food base in the Rogue River whose life history is associated with the substrate resulting from exposure to contaminated sediments.

Riparian vegetation. Agriculture, forestry, road building and maintenance, urbanization, and climate change has affected this PBF in the action area. Riparian vegetation contributes to food production and habitat complexity in the estuaries, which SONCC coho salmon require for migration and rearing in the estuary. The aforementioned management activities are likely adversely affecting the quality and function of this PBF in the Rogue and Chetco River estuaries.

Safe passage. Physical, chemical, or biological barriers that would impede or delay passage of adult and juvenile SONCC coho salmon to access feeding areas, holding areas, and thermal refugia and ensure passage back out to the ocean do not occur in the action area.

Space. Urbanization, road building and maintenance, and agriculture have reduced the quality and function of this PBF. Filling the estuaries to accommodate residential and commercial development and roads, construction of in-water and over-water structures, and construction of dikes and levees has reduced the amount of available space that adult and juvenile SONCC coho salmon would use for migration and rearing in the action area.

Substrate. Relative to SONCC coho salmon habitat needs in the context of this proposed action, substrate quality is determined by the physical composition and presence of chemical contaminants. Table 15 describes the physical composition of substrate (sediments) and identifies whether the dredge materials are suitable or unsuitable for unconfined in-water placement based on chemical analysis and review by the PSET under the guidance of the SEF (RSET 2016). The PSET determined that the Chetco River sediments would be suitable for unconfined in-water placement. Similarly, sediments from the Rogue River entrance channel and outer portion of the boat basin access channel would be suitable for unconfined in-water placement. However, at the last sampling event (September 18, 2012) the chemical analysis of sediments inner portion of the boat basin access channel showed that one sample contained a phenol concentration of 1,800 parts per billion (ppb), which exceeded the SEF (RSET 2016) screening level of 420 ppb. A sample collected in the same area in 2007 had a phenol concentration of 1,200 ppb. Furthermore, a number of the contaminants of concern had detection and quantitation levels above the marine screening levels. In June 2014, the Corps conducted marine bioassays on sediments within the inner boat basin access channel. The sediments failed the one-hit bioassays and phenol was again detected above its SEF (RSET 2016) screening level. Thus, the sediments were determined unsuitable for unconfined in-water placement.

Urbanization (bank armoring, construction of in-water and over-water structures with treated wood, and stormwater and municipal and industrial wastewater discharges), road building and maintenance, and upstream agriculture, and gravel mining has likely reduced sediment quality in the estuarine action area and, consequently, the quality and function of the substrate PBF.

Water quality. See the above discussion of water quality PBF for OC coho salmon. The Rogue and Chetco Rivers are on ODEQ's list for water quality limited waterbodies (Table 17). The previously mentioned key management activities have reduced the quality and function of this PBF in the estuarine action area.

Table 17. 303(d) listed estuaries in the Corps' coastal dredging action area overlapping with SONCC coho salmon designated critical habitat. TMDL – Total Maximum Daily Load.

Project name	Water quality parameter	River mile	Status
Rogue River	Fecal Coliform	0 - 27.2	Cat 5
	Temperature	0 - 124.8	Cat 4A
	Mercury	0 - 216.8	Cat 5
Chetco River	Biological Criteria	0 - 57.1	Cat 5
	Temperature	0 - 57.1	Cat 5

Cat 4A - TMDL approved – TMDL's needed to attain applicable water quality standards have been approved.
Cat 5 - Water is water quality limited and a TMDL is needed, Section 303(d) list.

Water quantity. See above discussion of this PBF for OC coho salmon.

Water temperature. As shown above in the water quality discussion, the Rogue and Chetco river estuaries are listed on ODEQ's list of water quality limited water bodies for water temperature. The quality and function of this PBF has been reduced from agriculture, forestry, road building and maintenance, and urbanization in and upstream of the estuarine action area.

Water velocity. Bank armoring and construction of in-water and over-water structures have likely impacted water velocity in the estuarine action area, however, water velocity in the estuaries is primarily influenced by tidal fluctuations and influenced very little by urbanization. Thus, urbanization has not meaningfully changed the quality and function of this PBF in the action area.

Green sturgeon critical habitat

Similar to OC and SONCC coho salmon, green sturgeon designated critical habitat PBFs include those that support juvenile, sub-adult, and adult green sturgeon in estuarine and coastal marine areas. The PBFs for green sturgeon include food resources, migratory corridor, sediment quality, water flow, water depth, and water quality. Green sturgeon critical habitat is designated in Coos Bay, Winchester Bay (Umpqua River), and Yaquina Bay and coastal marine areas out to 60 fathoms including ODMDS's at the Yaquina, Siuslaw, Umpqua, Coos Bay, Coquille, Port Orford, Rogue, and Chetco project areas.

Food resources. As described above, the estuarine action area contains several species of marine invertebrates and marine fishes including mysids, amphipods, copepods, and various life stages of bottom fish and pelagic forage fish. Prey species for subadult and adult green sturgeon primarily consist of benthic invertebrates and fish including crangonid shrimp, burrowing thalassinidean shrimp, amphipods, isopods, clams, annelid worms, crabs, sand lances, and anchovies (74 FR 52300). In the estuarine action area, abundance and quality of green sturgeon food resources have likely been affected by reduction and degradation of available habitat caused by urbanization (*i.e.*, estuarine fill, municipal wastewater and stormwater discharges), dredging, and road related stormwater discharge, which have reduced the quality and function of this PBF to support green sturgeon in the estuarine action area.

In coastal marine areas, the green sturgeon diet is likely similar to when feeding and rearing in bays and estuaries. For the Yaquina ODMDS's, EPA (2011) described the benthic infauna baseline by breaking data collected in 2008 down into four groups based on their similarities in relative impact from disposal of dredged material and includes: (1) North ODMDS drop zone; (2) southern part of north ODMDS; (3) south ODMDS; and (4) outside proposed ODMDS's. EPA (2011) considered the latter three groups baseline stations because they were relatively unimpacted by disposal at the time these data were collected. After comparing the number of species and individuals between the four sites (number of species and individuals were lower in North ODMD site drop zone than baseline stations), EPA (2011) stated that there appears to be a decrease in the numbers of species and individuals in response to disposal. This difference indicates a potential effect from disposal of dredged material at the disposal location. Prey organisms have likely responded similarly in the other ODMDS's throughout the action area as well, indicating that disposal of dredged material has contributed to reduced abundance of food resources in the disposal areas of the coastal marine action area. However, given the vastness of the Pacific Ocean and the available foraging area, the effect of past and present disposal of dredged material on food resources is minor.

Migratory corridor. Physical, chemical, or biological barriers that would impede or delay passage of subadult and adult green sturgeon to access feeding areas, holding areas, and thermal refugia and ensure passage back out to the ocean do not occur in the action area.

Sediment quality. See discussion above for marine sediments and estuarine sediment (SONCC coho salmon). As stated above, the sediments in the estuarine and marine action areas were determined to have no contaminants that were at levels of concern, with the exception of the inner portion of the Rogue River boat basin access channel where sediments were deemed unsuitable for in-water placement by the PSET. The Corps will not dredge those sediments until the Port of Gold Beach can identify an appropriate upland disposal site. Therefore, sediment quality is adequate to support green sturgeon.

Water flow. Water flow in the action area is subject to tidal influence and ocean currents and is adequate to support foraging and migration for subadult and adult growth and development of green sturgeon in the action area.

Water depth. A variety of depths exist in the estuarine action area with the deepest areas of the estuaries in the existing navigation channel sloping to shallower depths along the edges of the river channel and areas where dredging has yet to occur. In the coastal marine action area the depths vary in the ODMDS's and provide sufficient support for growth and development for adult and subadult green sturgeon.

Water quality. See discussion of water quality in the coastal marine, OC coho salmon, and SONCC coho salmon sections above. Water quality in the action area is degrades, but sufficient to support growth and development of green sturgeon in the action areas.

2.4.4 Species in the Action Area

OC coho salmon, SONCC coho salmon, and green sturgeon occupy the estuarine and coastal marine action area. OC coho salmon and SONCC coho salmon use the estuaries for rearing, migration, and to transition between fresh and saltwater and use coastal marine areas for rearing and migration. Generally, coho salmon adults migrate through the estuaries beginning in September through December while coho salmon smolts outmigration occurs February through June. While the migration of smolts mostly ends in June, it is likely that a few will remain in the project estuaries into the late summer to complete smoltification, temporally overlapping with dredging in the project estuaries. Following outmigration and ocean entry, coho salmon smolts will likely reside in the coastal marine action area for several months before migrating north. Adults will also be present in the coastal marine areas, as they will be congregating in the nearshore areas waiting to enter the estuaries for their spawning migration, temporally overlapping with the presence of smolts and dredging and disposal activities (Table 18). Individuals from the Tillamook; Yaquina; Siuslaw; lower, middle, north, and south Umpqua; Coos, and Coquille Rivers populations of OC coho salmon will be exposed to dredging while these and the Salmon; Siletz; Beaver; Alsea; Siltcoos, Tahkenitch, and Tenmile Lakes; Floras; and Sixes populations will be exposed to disposal of dredged material in the ODMDS's. Additionally, the lower, middle, and upper Rogue River and Illinois and Chetco Rivers populations of SONCC coho salmon will be exposed to dredging and disposal of dredged material in the ODMDS's.

Recently, the flexibility of pre-smolt coho salmon life histories, including the use of estuarine habitats and estuarine rearing during all parts of the year, has been documented (Cornwell *et al*. 2001, Miller and Sadro 2003, Koski 2009, Bennett *et al*. 2015, Weybright and Giannico 2016). Miller and Sadro (2003) observed pre-smolt OC coho salmon entering the estuary in the South Slough of Coos Bay during spring and remaining up to eight months, when they moved back upstream to overwinter. They also found pre-smolts moving into the estuary in the fall and winter with individuals having a mean residence time of 48 to 64 days per year. This life history variation has not been documented in all the project estuaries, but is likely present to some degree in the larger estuaries where dredging could occur at the up-river estuarine areas. Giving the benefit of the doubt to the species, we assume that in the larger estuaries with upriver dredging areas, individuals exhibiting these varied life history strategies would be present at some level during dredging and exposed to the project effects.

Green sturgeon use estuaries in the action area for growth and development and use the coastal marine areas for migration and growth and development. Green sturgeon congregate in coastal waters and estuaries, including non-natal estuaries. Beamis and Kynard (1997) suggested that green sturgeon move into estuaries of non-natal rivers to feed. Data from Washington studies indicate that green sturgeon will only be present in estuaries from June until October (Moser and Lindley 2007). Recent fieldwork indicates that green sturgeon generally inhabit specific areas of coastal estuaries near or within deep channels or holes, moving into the upper reaches of the estuary, but rarely into freshwater (WDFW and ODFW 2012). Green sturgeon in these estuaries may move into tidal flats areas, particularly at night, to feed (Dumbauld *et al*. 2008). Green sturgeon will be feeding and migrating in the action area from June to October and will be exposed to dredging in the project estuaries (Table 23). During the remaining months of the year green sturgeon will be present in the coastal marine areas and at times in the project ODMDS's.

The total abundance of green sturgeon is unknown (Adams *et al.* 2007), therefore the abundance of the green sturgeon that would use the ODMDS's is unknown but likely to be very low. Lindley *et al.* (2008) tracked the migrating tagged green sturgeon along the west coast (Figure 20). It is apparent green sturgeon are migrating along the Oregon coast, but when they actually enter the ODMDS's is unknown. In addition to their exact location, these migrating fish are likely moving through the area at a high rate of speed (Lindley *et al.* 2008) and therefore not likely to stay within an individual action area very long. The most likely migration scenario where green sturgeon might enter an ODMDS in the action area would be for green sturgeon that are headed into a project estuary. It is at this time an individual could be exposed to disposal of dredged material.

Table 18. Life history timing for coho salmon and green sturgeon presence corresponding to the proposed action at the Corps' Oregon Coastal projects. (http://nrimp.dfw.state.or.us/nrimp/default.aspx?p=326).

Period of peak use (90% life history stage use)
Period of lesser use (10% life history stage use)
Adult/sub-adult green sturgeon presence
Timing of Corps' dredging and disposal activities

Project/species timing	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Tillamook Bay												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Boat basin access												
Depoe Bay												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Boat basin												
Sediment check dam												
Yaquina Bay												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Entrance channel[1]												
Boat basin access												
Depot Slough												
Siuslaw River												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Ent./Nav. Channel												
Umpqua River												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Ent./Nav. Channel[2]												
Boat basin access												
Coos Bay												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Entrance channel[3]												
Nav. Channel RM 1-12[4]												
Nav. Channel RM 12-15												
Charleston access chnl[5]												

Project/species timing	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Coquille River												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Entrance channel												
Boat basin access												
Port Orford												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Port Orford dock												
Port Orford channel												
Rogue River												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Entrance channel												
Boat basin access												
Chetco River												
Adult coho salmon												
Smolt coho salmon												
Green sturgeon												
Entrance channel												
Boat basin access												

[1] 6 dredging days in April or May

[2] 4 dredging days in April or May

[3] 5 dredging days in April or May

[4] 6 days in April or May

[5] 9 dredging days in April, May, or June

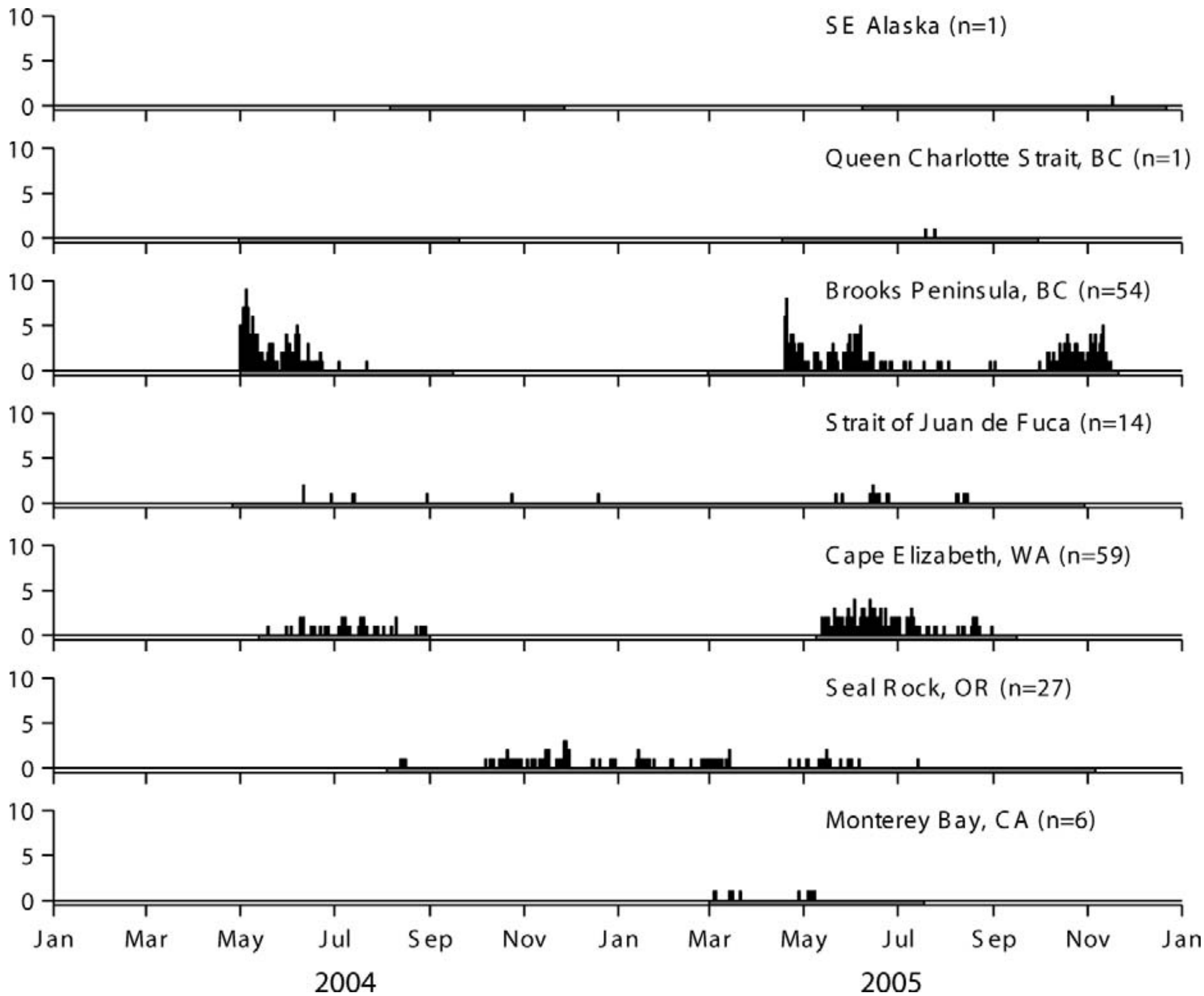

Figure 20. From Lindley *et al*. (2008) – detections of pinger-tagged green sturgeon by hydrophone arrays along the West Coast of North America (n = total number of unique fish observed at each location). Bar height indicates the number of unique fish observed per day.

Previously mentioned land and waterway management activities have degraded aquatic habitat important for successful production of OC and SONCC coho salmon and green sturgeon in the action area. As a result, OC and SONCC coho salmon and green sturgeon occurring in the action area have been adversely affected by the degraded condition of aquatic habitat. The response of these species is not immediately apparent, but can be observed in individuals' reduced growth, survival, and fitness, and overall abundance over the long-term in the action area. While the habitat in the action area is degraded, it provides support for OC and SONCC coho salmon and green sturgeon production.

2.5. Effects of the Action

Under the ESA, "effects of the action" are all consequences to listed species or critical habitat that are caused by the proposed action, including the consequences of other activities that are caused by the proposed action. A consequence is caused by the proposed action if it would not occur but for the proposed action and it is reasonably certain to occur. Effects of the action may occur later in time and may include consequences occurring outside the immediate area involved in the action (see 50 CFR 402.17). In our analysis, which describes the effects of the proposed action, we considered 50 CFR 402.17(a) and (b).

2.5.1 Effects on Critical Habitats

Dredging and disposal of dredged material will occur in estuaries and in coastal marine areas that are occupied by multiple life stages of OC coho salmon, SONCC coho salmon, and green sturgeon, meaning that multiple PBFs necessary to support these species will be affected. Effects of the proposed action occur within the fifth-field watersheds identified in Tables 14 and 15, and as described in the status of critical habitat, these areas are designated for OC coho salmon, SONCC coho salmon, and green sturgeon. Green sturgeon critical habitat also includes the Pacific Ocean out to a depth of 60 fathoms.

OC coho salmon critical habitat

The Tillamook Bay, Depoe Bay, Yaquina Bay, Siuslaw River, Umpqua River, Coos Bay, and Coquille River project estuaries are designated critical habitat for OC coho salmon. The PBFs of critical habitat in the action area that support growth and development of OC coho salmon include forage, natural cover, water quality, water quantity, salinity, and passage free of obstruction. The coastal marine action area where disposal of dredged material will occur is not designated critical habitat for OC coho salmon.

Forage. Dredging in the navigation and boat access channels is likely to reduce abundance of OC coho salmon prey organisms via benthic habitat modification and entrainment. Dredging will reduce the amount of and quality of prey organism habitat by simplifying the character of substrate within the action area. Continuous dredging will also maintain this reduced amount and quality of prey organism habitat, effectively maintaining prey organism abundance at lower levels than would occur in the absence of dredging

Removal of eelgrass beds from the bays and estuaries associated with the Oregon Coastal Projects (e.g. Tillamook Bay, Yaquina Bay and River, Siuslaw River, Umpqua River, Winchester Bay, Coos Bay) will reduce primary production in the area where dredging occurs and also potentially reduce prey availability to OC coho salmon and green sturgeon by removing habitat that contributes to the system at multiple trophic levels. Eelgrass functions as important structural environment that forms the base of the detrital-based food webs, and is a source of secondary production, supporting epiphytic plants, animals, and microbial organisms that in turn are grazed upon by other invertebrates, and larval and juvenile fish (NMFS 1997). The rate of recovery for the eelgrass beds is not clear, and the authorized navigation channels and the proposed disposal site are likely to never fully recover because of the frequency of dredging and disposal. However, we expect that the amount of eelgrass likely to be affected by dredging, and the corollary effects to prey availability, will be only a small reduction because dredging is most likely to occur outside of eelgrass habitat, and if eelgrass is present, the degree of impacted area compared to the amount of eelgrass habitat available in the Oregon Coastal Project's bays and estuaries would be small. Because the area of eelgrass impacted would be small, the loss should not result in a meaningful reduction of forage abundance.

Entrainment of prey species during dredging will also reduce the overall abundance of prey organisms in the action area. Armstrong *et al.* (1981) reported entrainment of Dungeness and blue crabs, shrimp, bivalves, and several fish species during entrainment studies in Grays Harbor, Washington, of which the larvae are prey for OC coho salmon. It is likely that dredging in the navigation and boat basin access channels will entrain OC coho salmon prey organisms; however, these channels are located in dynamic, high energy, and frequently disturbed areas of the project estuaries for which OC coho prey organisms are highly adapted to. Furthermore, the use of the dredging areas are limited because OC coho salmon typically pass quickly through the action areas on-route to the ocean as there is little of the preferred complex, off-channel/tidal channel habitat elements within the entrance and/or navigation channels or boat basin access channels.

Unconfined in-water disposal of dredged sediments at the in-bay disposal sites will cover infaunal and epifaunal invertebrates with a layer of sandy sediment because disposal of dredge materials contributes a layer of unconsolidated sediment on the floor of the disposal location. The result would be a change in the food source and habitat available to OC coho salmon prey organisms in the area for an uncertain amount of time. However, the in-bay disposal sites are in the flow-lane and dispersive, so the effect to forage will be short-term (months) and localized to the in-bay disposal area. These areas are characterized as dynamic and high-energy environments, thus the effect to the available forage is minor and prey organisms associated with this type of environment will likely quickly recolonize the area.

After considering all the potential pathways for the proposed action to affect the forage PBF, and given the fact that estuarine prey is not limiting productivity of OC coho salmon, the effects on the forage PBF from the proposed action are minor and will not meaningfully change or alter the quality and function of this PBF to support OC coho salmon in the action area.

Natural cover. There is potential that during dredging the Corps could encounter submerged aquatic vegetation, which provides predator avoidance and foraging habitat for OC coho salmon. Prior to the start of dredging and disposal in areas where SAV is known to occur, the Corps would conduct a seagrass survey. If seagrass were present in the proposed dredge area, the Corps would consult with NMFS to develop a plan to avoid the vegetated area to the maximum extent practicable. Thus, it is unlikely that dredging would significantly change quality or function of this PBF in the action area.

Water quality. Dredging and in-river disposal will increase suspended sediments and chemical contaminants in the water column for the duration of dredging at each project-estuary. Such an increase is not likely to be significant because of the majority of the dredging will use hydraulic (hopper, pipeline) dredges, which generally do not produce large amounts of suspended sediments. Suction of the dredge pump and the buried dragheads limit the amount of suspended sediments.

When mechanical dredging or in-river disposal occurs, the amount of suspended sediment produced depends on the sediment composition and the type of bucket used during the mechanical dredging. Additionally, the duration and location of suspended sediment is also a function of river flow, tidal action, currents, and wave activity relative to the dredging and/or disposal location, as these will dissipate the suspended sediment plume.

The greater the proportion of fine sediments, the more likely dredging or disposal will result in an increase in suspended sediments. For the proposed action the majority of the dredged material is expected to be sand, which does not stay suspended in the water column for a significant length of time, meaning that at the entrance and navigation channels near the river mouths the water quality impact will be both localized and of short duration.

Where there is finer-grained material dredged from some of the boat basin access channels and upriver areas, sediment may stay suspended in the water column for a longer time depending on the dredging method (pipeline, mechanical). The suspended sediment plume is expected to extend from the point of dredging to roughly 200 feet outside the specific dredging areas, or 500 feet outside the boundary of disposal areas where, during pipeline dredging or disposal in-river sites concentrations will have dissipated to background levels in a few hours resulting in localized and short-term minor effects that would not change the quality or function of water quality in the action area.

During mechanical dredging (clamshell) suspended sediment concentrations and the plume duration will exceed the thresholds that cause adverse effects to water quality. Suspended sediments may be estimated by turbidity measurements in Nephlometric Turbidity Units (NTUs), which is a measure of light scattered by particles suspended in liquid. The threshold for adverse effects of suspended sediments to water quality is 20 NTUs for a period of 4 hours or more (Berg and Northcote 1985; Robertson *et al.* 2006). Increases in turbidity will exceed 20 NTUs for greater than 4 hours in areas dredged mechanically, particularly if the area contains high levels of finer-grained matter, such as many of the boat basin access channels and up-river dredging areas. Typically, these areas are dredged on a 5 to 8 year rotation and would adversely affect the quality and function of the water quality PBF for the duration of the mechanical dredging activity in the location(s) of occurrence every 5 to 8 years.

Dredging and disposal will mobilize chemical contaminants including metals, TOC, pesticides and PCBs, phenols, phthalates, and miscellaneous extractables, PAHs and organotin into the water column, to the degree that these are present in the sediment being disturbed. The Corps conducts sediment sampling and analysis at each of the coastal projects on a five-year cycle. Physical analysis for material within the river entrance and navigation channels indicates the material is primarily sand, the boat basin access channels being composed primarily of sandy-silt material, and Depot Slough at Yaquina being primarily silt. The chemical analyses indicated only trace levels of contamination in any of the samples, with all levels below their respective DMEF or SEF screening levels and suitable for unconfined in-water disposal. Therefore, because disturbed sediments do not contain significant contaminants of concern; dredge- and disposal-induced suspended sediments are expected to be localized, short-lived and temporary; and the timing of dredging and in-river disposal will occur when sensitive life stages of OC coho salmon (smolts) are not likely present, the quality and function of the water quality PBF will not change from the resuspension of trace amounts of contaminants or increases in suspended sediments.

Water quantity. Water is removed during hydraulic and mechanical dredging; however the amount is very minimal and operation of the hopper, pipeline, and mechanical dredges are such that the water is quickly returned to the estuary. Given the volume of water in the estuarine habitat, the operation of the dredge will not have a discernible effect on the volume of water within the action area. Thus, the proposed action will not change the quality and function of this PBF in the action area.

Salinity. There is no mechanism of the proposed action to affect this PBF, thus the proposed action will not affect the quality and function of this PBF.

Free of artificial obstruction. Dredging using a hydraulic (hopper, pipeline) will cause a partial physical obstruction to passage during smolt migrations. During dredging there exists a small zone of influence around the pipeline or cutterhead. High velocities of water and sediment pulled into the pipeline by a centrifugal pump characterize the zone of influence. Juvenile smolt coho salmon are most susceptible to this zone of influence. The higher velocities present a partial obstruction to passage through the action area that will be localized around the pipeline or cutterhead and periodic during dredging in the action area. Typically the hopper dredging occurs for 1 to 2 hours before transport of dredged material to an ODMDS or in-river disposal site. Thus, this PBF will be periodically and temporarily adversely affected during implementation of the proposed action, however the adverse effect will be localized to a small area surrounding the cutterhead or pipeline.

SONCC coho salmon critical habitat

The Rogue and Chetco river project estuaries are designated critical habitat for SONCC coho salmon. The PBFs of critical habitat in the action area that support growth and development of SONCC coho salmon include cover/shelter, food, riparian vegetation, safe passage, space, substrate, water quality, water quantity, water temperature, and water velocity. The coastal marine action area where disposal of dredged material will occur is not designated critical habitat for SONCC coho salmon.

Cover/shelter. See discussion of natural cover PBF for OC coho salmon above. Similarly, it is unlikely that dredging would significantly change quality or function of this PBF in the action area.

Food. See discussion of forage PBF for OC coho salmon above. Similarly, the effects on this PBF because of dredging are minor and would not meaningfully change the quality and function to support SONCC coho salmon in the action area.

Riparian vegetation. There is no mechanism of the proposed action to affect this PBF, thus the proposed action will not affect the quality and function of this PBF.

Safe passage. See discussion of free of obstruction PBF for OC coho salmon above. Similarly, this PBF will be periodically and temporarily adversely affected during dredging.

Space. A purpose of maintenance dredging is lowering the elevation of the estuary and riverbed. This is the result of extracting sediments from the riverbed at a faster rate than recruits to the area. The proposed dredging will create space by deepening the entrance, navigation, and boat basin access channels, but this beneficial effect will be minor.

Substrate. The total footprint of the Rogue River portion of the action area is approximately 50.7 acres except for the 2021 dredging season when the Corps will also dredge the AMD gravel bar upstream of the boat basin access channels. This will add approximately 16 acres of disturbed substrate in the action area of the Rogue River for 2021. The total footprint for the Chetco River portion of the action area is 18.2 acres. Dredging will occur annually within the entrance channels at the Rogue and Chetco projects, approximately 40 acres and 13.1 acres in size respectively. The turning areas and boat basin access channels will be dredged once every five years; these areas encompass 10.7 acres at the Rogue River and 5.1 acres at the Chetco River. Dredging in the AMD gravel bar at the Rogue River will occur only in 2021. However, dredging does not typically occur over the entire footprint of the navigation channels equally. At the entrance channels, this impact will occur at specific locations where shoals have developed since the previous year of dredging. In the case of the turning areas and boat basin access channel, these areas may be dredged more equally due to the time between dredging events. The sediments to be removed are evaluated on a five-year cycle, and both current and historic analysis indicates that the substrate in the entrance channel is primarily composed of sand and the outer boat basin access channel composed primarily of sandy-silt material; these sediments contain only trace concentrations of contaminants. The AMD gravel bar is comprised of primarily coarse sand, gravels and cobbles. Nonetheless, because the disturbance to the substrate is expected to be localized, short-lived, and temporary, the proposed dredging will not change the quality and function of this PBF.

Water quality. See discussion of water quality PBF for OC coho salmon above. Similarly, the quality and function of the water quality PBF will not change from the resuspension of trace amounts of contaminants or increases in suspended sediments.

Water quantity. See discussion of water quantity PBF for OC coho salmon above. Similarly, the proposed action will not change the quality and function of this PBF in the action area.

Water temperature. There is no mechanism for the proposed action to affect this PBF.

Water velocity. Similar to the safe passage PBF, water velocities will be increased in the zone of influence around the pipeline or cutterhead, resulting in periodic and temporary adverse effects to this PBF during dredging.

Green sturgeon critical habitat

The Yaquina Bay, Umpqua River, and Coos Bay project estuaries are designated critical habitat for green sturgeon, as is the coastal marine areas where disposal of dredged material will occur.

The PBFs of critical habitat in the action area that support growth and development of green sturgeon include food resources, migratory corridor, sediment quality, water flow, water depth, and water quality.

Food resources. Dredging will temporarily affect food resource availability in the navigational and access channels of Yaquina, Winchester (Umpqua) and Coos bays following dredging activities. Green sturgeon use the navigation channels at these three projects primarily as a migratory route in-and-out of and through the estuaries. Subadult and adult southern green sturgeon may forage in the channels as they transit through, but likely pass through the action areas to more optimal foraging habitats within these estuaries. Nonetheless, dredging will result in the loss of aquatic invertebrates in portions of the navigational channels and will cause a small decrease in food availability for subadult and adult green sturgeon; however, these channels are located in dynamic, high energy, and frequently disturbed areas of the project estuaries to which green sturgeon prey organisms are highly adapted. Therefore, these temporary reductions in prey are confined to the navigational channels, and are not expected to significantly decrease prey availability within the remainder of the estuarine habitat where we expect sturgeon to engage in forage behavior.

Food resource availability will temporarily decrease at the unconfined in-water disposal locations due to dredged material covering the substrate and any substrate dwelling organisms being buried. Except for the in-bay disposal site 8.4 at Coos Bay, the other disposal sites are in high-energy, dispersive locations that are typically inhabited by opportunistic organisms adapted to frequent disturbance.

Disposal of dredge materials contributes a layer of unconsolidated sediment on the river and/or ocean floor. In doing this, infaunal and epifaunal invertebrates will be covered with a layer of sandy sediment. All the in-water disposal sites are monitored annually to assess mounding, which was previously discussed. Although long-term mounding is not apparent from the monitoring, the short-term deposition of this material before the winter storms disperse the material may result in some reduction of invertebrates on the river and/or ocean floor. The result would be a change in the food source and habitat available to benthic organisms in the area for up to 6 or 7 months between the disposal and when the winter storms disperse the material. The likely change in prey species is dependent then on the recolonization rate of this area.

Recolonization is uncertain at any of the sites while the site is in active use for dredged material disposal. The maximum interval between disposal events is approximately one year, except at Tillamook Bay where disposal will occur every five to eight years. Recolonization potential is affected by the length of intervals between deposition events, particle size, river flows, currents, and compaction/stabilization following deposition (Newell *et al.* 1998; Van der Veer *et al.* 1985). Rates of recovery listed in the literature range from several months for estuarine muds, and up to two to three years for sands and gravels (Hitchcock *et al.* 1999). Recolonization may take longer in areas with lower current (Van der Veer *et al.* 1985). These sites (except for Coos Bay Site 8.4) are indicative of a dynamic ecological zone that naturally would be characterized by a disturbance-based ecosystem. Disturbance based ecosystems are indicative of rapid recolonization rates by opportunistic organisms tolerant of conditions that are physiologically stressful (Pemberton and MacEachern 1997).

At Coos Bay Site 8.4, dredged sediments added annually, and then dredged every five to ten years and disposed of at ODMDS F. Because this site is not dispersive suggests lower flow and potentially slower recolonization rate. Even if rates of recolonization are slower than other disposal areas, the total area of this disposal site is 17.2 acres. According to the Coos Bay Estuary Plan (1975), the Coos Bay embayment, including South Slough, contains about 10,500 acres. Therefore, the affected area where prey will be diminished represents approximately 0.2% of the Coos Bay estuary.

Although conducting feeding studies on green sturgeon have proven difficult, some information is available. In addition to various invertebrates, green sturgeon appear to be opportunistic foragers and feed on various fish species, such as lingcod (Dumbauld *et al.* 2008), herring (Erickson and Hightower 2007), sand lace and anchovies (Moyle 2002) which may also be adversely impacted by the disposal. Similar exposure, avoidance response, and risks are likely with forage fish species as were described for the coho salmon and green sturgeon. Typically these fish are smaller species and less likely to avoid physical harm. The number of prey individuals affected is difficult to estimate, but the number affected would not be meaningful relative to the overall abundance of forage available to southern green sturgeon. Because these impacts to forage base are highly localized and temporary, the likely decrease in forage abundance is minor and not meaningful to this PBF and its support of green sturgeon. Thus, dredging or disposal will not change the quality and function of this PBF in the action area.

Migratory corridor. See discussion of free of artificial obstruction PBF for OC coho salmon above. Conversely to the conclusion of the PBF for OC coho salmon, the zone of influence created by dredging is unlikely to be meaningful to the migratory corridor PBF for green sturgeon because of the life stages of green sturgeon that will be present. Adult and sub-adult green sturgeon are not as susceptible to the zone of influence because of their size combined with their swimming speed and ability. Thus, the zone of influence created by dredging will not change the quality and function of this PBF of green sturgeon in the Yaquina Bay, Umpqua River, or Coos Bay project estuaries.

The impact of disposal to the migratory corridor is best described by briefly explaining the interaction between green sturgeon and the disposed material. Adult and sub-adult green sturgeon will inhabit in-river disposal sites and ODMDS's during the Corps' disposal of dredged materials. During disposal green sturgeon exposure to dredged material will occur as the disposal plume descends through the water column. Adult and sub-adult green sturgeon will likely react to the descending plume by exhibiting an avoidance response. Adult green sturgeon are capable of avoiding the descending plume because of their swimming ability; however, some smaller sub-adults will not be able to avoid the descending dredged material, which will delay or prevent migration for those individuals. Disposal of dredged materials may temporarily modify adult and sub-adult migration routes, delay, or prevent migration for some sub-adults directly affected by the dredged material. Exposure to dredged material will on a periodic basis as disposal is not continuous and occurs only when a hopper, barge, or scow is filled by dredging. Therefore, disposal of dredged material will periodically adversely affect the quality and function of this PBF to support sub-adult green sturgeon migration in the action area.

Sediment quality. Dredging and disposal of accumulated sediments from the Oregon coastal projects will disturb and mobilize potentially contaminated sediments in the water column. The Corps began collecting sediment quality data from the Oregon coastal projects in the late 1970s. The Corps continues to conduct sediment sampling and analysis at the coastal projects on a 5-year cycle. Currently, sediment sampling and analysis for the coastal projects follows regional screening levels that have been adopted for use in the SEF. The history of sediment sampling shows that concentration of contaminants in the sediments at the coastal projects is extremely low, and remains below the screening levels as set forth in the DMEF or the SEF. The Corps intends to continue to sample the sediments at the Oregon coastal projects, which rank "low" in potential for contaminants according to the SEF guidelines, on the 5-year cycle, which exceeds the sampling frequency guidance in the SEF. Therefore, because the current and historical sediment characterization at the Oregon coastal projects has detected only very small amounts of contaminants and sampling will continue on the 5-year cycles, the NMFS is reasonably certain trace concentrations of contaminants will continue to occur, but not at concentrations that would change the quality and function of this PCE to support green sturgeon.

Water quality. See discussion of water quality PBF for OC coho salmon above. Additionally, disposal of dredged material will increase suspended sediment concentrations and, consequently, turbidity levels in the ODMDS's. Turbidity levels are likely to increase for a short time with the highest concentrations occurring at the ship's disposal point and dispersing from that point depending on river flow, tidal fluctuations, ocean currents, disposal material size composition, wave action, dredge ship speed, and disposal rate. The NMFS predicts the turbidity will drift approximately 500 feet outside of unconfined in-water disposal areas. It is likely that suspended sediment concentrations generated by dredge material disposal will exceed the 20 mg/l effects threshold as described above for salmonids, but because adult and subadult green sturgeon inhabit much more turbid environments than do salmonids, they are likely far less sensitive to turbidity and suspended solids than salmonids. Therefore NMFS is reasonably certain these elevated turbidity concentrations will occur, but the exposure will be short-term and will not meaningfully change the quality and function of this PBF.

As described below, sediments dredged from the Oregon coastal projects are primarily large-grained sands and while trace levels of various contaminants may occur in the sediments, these levels will not exceed concentrations harmful to the organisms occupying the action area; therefore disposal of this dredge material will not alter the quality and function of this PBF.

Summary of effects on critical habitat

Critical habitat in the action area supports OC coho salmon and SONCC coho salmon rearing and migration and adult and sub-adult green sturgeon growth and development. The PBFs for OC coho salmon present in the action area include forage, natural cover, water quality, water quantity, salinity, and free of artificial obstruction. The PBFs for SONCC coho salmon include cover/shelter, food, riparian vegetation, safe passage, space, substrate, water quality, water quantity, water temperature, and water velocity. For green sturgeon, PBFs include food resources, migratory corridor, sediment quality, and water quality.

The water quality PBF for OC and SONCC coho salmon will be periodically and temporarily adversely affected during mechanical dredging of some of the boat basin access channels and the up-river navigation channel areas due to mobilization of suspended sediments in the water column up to 200 feet away in all directions from the mechanical dredge. The adverse effect to the water quality PBF will occur for the duration of the mechanical dredging event (days to weeks) every 5 to 8 years.

The zone of influence created by hydraulic dredging will be periodically and temporarily adversely affected, effecting the free of artificial obstruction (OC coho salmon) and safe passage and water velocity (SONCC coho salmon) PBFs because the water velocities associated with the zone of influence will prevent some OC and SONCC coho salmon smolts from completing their migration to the ocean by entraining them in the dredge.

The migratory corridor PBF for some sub-adult green sturgeon will be adversely affected periodically and temporarily during disposal of dredged material as their interaction with this material will cause a delay of or prevent migration of some individuals. The proposed action will not meaningfully change the quality and function of any other PBFs for OC coho salmon, SONCC coho salmon, or green sturgeon.

The effects on OC and SONCC coho salmon and green sturgeon critical habitat are likely to be significant only for a short time periodically throughout the day or for days to weeks every 5 to 8 years and localized to a small area of critical habitat (i.e. 200 feet from mechanical dredge, zone of influence of cutterhead or pipeline, and area of dredged material disposal plume). Over all the adverse effects will affect a small portion of critical habitat at any one time, so that the proposed action will not degrade the PBFs essential for OC and SONCC coho salmon and green sturgeon at the fifth-field watershed, or designated critical habitat unit scale.

2.5.2 Effects on ESA-listed Species

In Section 2.4.4 (*Species in the action area*) of this opinion we established temporal and spatial overlap of OC coho salmon, SONCC coho salmon, and green sturgeon and the Corps' proposed dredging and disposal activities in the project estuaries and the coastal marine action area.

Physical injury

Entrainment during dredging. For a fish to avoid entrainment into the draghead it must first detect and react to the ship, cutterhead, or pipeline, and then the fish must react quickly to avoid exposure to the zone of influence around the cutterhead or pipeline. Smolt OC and SONCC coho salmon will be passing through the riverine/estuarine portions of the individual project action areas on route to the ocean, and therefore are at an increased risk of exposure due to the presence of the cutterhead or pipeline in the migratory corridor. Noise and vibration from the dredge vessel and cutterhead or pipeline during operation may discourage most fish from getting close and thereby avoid encountering the zone of influence.

When juvenile salmonids come within the zone of influence of the cutter head, they may be drawn into the suction pipe (Dutta 1976; Dutta and Sookachoff 1975a). Dutta (1976) reported that salmon fry were entrained by hydraulic pipeline dredging in the Fraser River. During studies by Braun (1974a, 1974b) almost 99% of entrained juveniles were killed. Hydraulic pipeline dredging operations caused a partial destruction of the anadromous salmon fishery resource of the Fraser River (Dutta and Sookachoff 1975b). Hydraulic pipeline dredges operating in the Fraser River during fry migration took substantial numbers of juveniles (Boyd 1975). Further testing in 1980 by Arseneault (1981) found entrainment of chum and pink salmon but in low numbers relative to the total of salmonids outmigrating (0.0001 to 0.0099%).

The Corps conducted extensive sampling during hydraulic dredging within the Columbia River in 1985-88 (Larson and Moehl 1990) and again in 1997 and 1998 in Oregon coastal bays and estuaries. In the 1985-88 study, no juvenile salmon were entrained, and in the 1997-98 study two juvenile salmon were entrained (R2 Resource Consultants 1999). Examination of fish entrainment rates in Grays Harbor from 1978 to 1989 detected only one juvenile salmon entrained (McGraw and Armstrong 1990). Dredging was conducted outside peak migration times. No evidence of fish mortality was found while monitoring dredging activities along the Atlantic Intracoastal Waterway (Stickney 1973). These conflicting Fraser and Columbia River studies examined deep-water areas associated with main channels. There is little information on the extent of entrainment in shallow-water areas, such as those associated with the proposed action.

In the absence of definitive information, the NMFS makes the biologically conservative assumption that hydraulic and/or pipeline dredging in shallow-water areas of the navigational channels is likely to entrain some juvenile OC and SONCC coho salmon, if they are present during operations. The timeframe for dredging operations vary by project, but some are scheduled to occur during the OC and SONCC coho salmon outmigration period, and will continue into the over-summer period when green sturgeon are present. The proposed conservation measure to maintain the cutterheads and dragheads in the sediment, or no more than three feet above the river bottom, is likely to reduce, but not eliminate, the probability for entrainment of OC and SONCC coho salmon individuals. Adult coho salmon will be able to swim away from the disturbance and will not be entrained during dredging.

Number exposed. Estimating the number of individual fish injured or killed from entrainment during dredging at is difficult because the number of fish passing through each of the individual project action areas will vary from day-to-day and the number of individuals moving into the site between dredging events is unknown. Further, dredging primarily occurs outside of peak migration periods for OC and SONCC coho salmon. Dredging does not typically occur over the entire navigational channel footprint and annual dredging focuses on those areas in the channel where shoals have developed since the previous year’s dredging. Some locations that will only be dredged once every five to eight years may be dredged more uniformly. Based on these, the number of OC and SONCC coho salmon is likely low.

Using the previously developed methodology to estimate the number of individuals exposed to the effects of dredging (NMFS 2005), we estimated the number of individuals exposed to dredging and potential entrainment at each of the Oregon coastal projects (Table 18). The first step is calculating the percent area of the navigation channel to be dredged in a given year relative to the total navigation channel area. We used total navigation channel area multiplied by the average channel depth to calculate a relative volume. We then used the average estimated number of smolts divided into the relative cross-sectional volume to generate a fish density. Then a volumetric dredge cell was estimated to calculate a fish density relative to a given dredge cell within the cross section. After factoring minimum dredge elevations, equipment operations, and dredge intake velocities, we calculated a percent of the water column relative to the entrainment zone and fish use potential to estimate a number of fish in the entrainment zone. We then calculated relative fish abundance at peak outmigration and non-peak outmigration over the proposed dredging season to estimate the number of fish subject to entrainment relative to season. This number was then divided by the number of likely hours that dredging occurs per year. We then multiplied by a residence time coefficient and then multiplied by an error coefficient calculated from the total estimate of juvenile salmonids abundance in the lower river reaches of the project.

The number of OC coho salmon outmigrants from the Oregon Coastal Projects has not been studied to provide a reliable estimate by direct sampling. We can estimate this number by back-calculation dividing the number of returning adults by marine survival. Using the average number of adults returning in the period 1990 to 2007, we can estimate the average number of outmigrants. While this extrapolation is not optimal, the NMFS considers that it is the best information and is adequate for use in the analysis portion of this opinion.

Based on this analysis, we estimated that a maximum of 151 (range 0 – 151) OC coho salmon smolts may be entrained during dredging operations each year (Table 19). Further, dredging may entrain a maximum of 18 SONCC coho salmon each year (Table 19). Of those individuals entrained during dredging, we assume a 100% mortality rate due to the nature and characteristics of entrainment through the cutterhead or pipeline. In 2021, dredging in the Rogue River at the AMD gravel bar will occur using mechanical methods, which is unlikely to result in entrainment of individual fish because they are capable of avoiding the clamshell bucket and outmigrating coho salmon smolts are unlikely to be present in the estuary at the time at which this dredging would occur.

Table 19. Number of yearling OC and SONCC coho salmon outmigrating from Oregon coastal project river basins (estimated by back-calculation) and associated numbers of coho smolts entrained during dredging.

Project	Average number of adult returns	Average number of outmigrating smolts	Maximum number of smolts injured or killed per year
Tillamook Bay	7,769	194,225	0
Depoe Bay	Unknown	Unknown	0
Yaquina Bay	7,981	199,528	32
Siuslaw River	15,816	395,408	19
Umpqua River	35,995	899,865	71
Coos Bay	12,475	311,873	11 / 12 / 6*
Coquille River	18,546	463,650	0
OC coho salmon total			151
Port Orford	NA	NA	0
Rogue River	5,258	131,450	18**
Chetco River	75	1,875	0
SONCC coho salmon total			18

* Number of individuals entrained at Coos Bay was calculated for three separate reaches; entrance, RM 1 to RM 12, and the Charleston access channel
** Because of the annual increase for dredged material, we expect the number of SONCC coho salmon smolts entrained to double.

Most of the Corps dredging operations are complete prior to the return of adult OC coho salmon to their natal river basins, but in some cases there is overlap of dredging activities with returning adults. It is not clear how they would respond to the draghead and the zone of influence around the draghead should they be in proximity to an active dredging operation. The darting speed of adult coho salmon may exceed 20 feet/second (Bell 1990), and due to the larger size and faster swimming speeds of adult OC coho salmon, they are likely able to swim away from active dragheads and/or cutterheads. Therefore, entrainment of adult OC or SONCC coho salmon is not likely to occur.

Green sturgeon migrate along the Oregon coast, and are known to enter Oregon's larger bays and estuaries. They are suspected to enter the smaller bays and estuaries, although this has not yet been confirmed. Dredging studies on the Columbia River captured a single juvenile white sturgeon, indicating that there is a risk to small sturgeon becoming physically entrained during dredging operations (R2 Resource Consultants 1999). A 2011 biological opinion issued by the Southeast Region of NMFS for the Savannah Harbor Expansion Project estimated sturgeon catch-per-unit-effort (CPUE) based on two observed Atlantic sturgeon entrainments by hopper dredging that removed 13,325,513 cy of material between 2007 and 2009. Spatial and temporal overlap with dredging increases the probability that green sturgeon may encounter the zone of influence near an active cutterhead or pipeline. However, because southern green sturgeon do not spawn in any of the rivers associated with the Oregon coastal projects, small juvenile green sturgeon are not considered to be present. For subadult and adult green sturgeon, the hopper dredges only operate one or two drag arms at a time, resulting in a low probability of a green sturgeon individual of encountering the zone of influence near and active cutterhead or pipeline. Additionally, the hopper dredges when dredging are slow moving, follow a predictable course, and subadult and adult southern green sturgeon that may be present are likely large enough to swim away and avoid the zone of influence after detection of the disturbance. Thus, green sturgeon are unlikely to be entrained during dredging.

Entrainment during disposal. At the Oregon coastal projects, most of the dredged material disposal occurs at ocean disposal sites. In-river/bay disposal occurs at the Tillamook, Umpqua, Coos Bay, and Coquille river projects. Disposal in these estuaries primarily occurs following the outmigration of coho salmon smolts; there is no estuarine disposal at the Rogue or Chetco projects where SONCC coho salmon occur. In some cases, particularly the boat basin access channel, disposal will occur every five to eight years. At some projects, material may be disposed of at an upland location, and this would reduce the magnitude of adverse effects from disposal. However, it is not clear where or when material would ultimately be disposed of upland or how much material would be disposed of in this manner. Therefore, we must evaluate the impact to individuals with the reasonable assumption that all dredged material will be disposed of in-water.

Two primary dredged material disposal methods involve unconfined in-water disposal that may be employed at the Oregon coastal project, dumping from a hopper dredge or dump barge or discharge from a pipeline dredge. A dumping creates a discharge field from the bottom of the vessel hull to the bottom of the disposal area, and occurs at a separate location from where the material was dredged. Discharge of dredged materials using pipeline-discharge would occur simultaneously with dredging and typically occurs nearer the actual dredging location.

The in-water disposal by pipeline will create a discharge field that may range from 150 to 500 feet in length and 100 to 200 feet wide, depending on dredged material, discharge rate, tidal conditions, and river velocities. Juvenile coho salmon are likely to use the upper 20 to 25 feet of the water column, although they may use water column depths ranging from 22 to 37 feet (Carlson *et al.* 2001; Beeman *et al.* 2003). Pipeline dredges typically use a 30-inch pipeline with discharge velocities of at least 25 feet/second. However, discharge typically occurs at a minimum of 20 feet below the water surface elevation, although greater depths are possible. While individuals may be present at the initial start-up, NMFS is reasonably certain that during operations, OC and SONCC coho salmon or green sturgeon could easily move out of the area to avoid the discharge plume. Further, it seems unlikely that individuals would swim into the discharge field, but would avoid the area and thereby avoid injury. In order to assess the physical risk posed by the exposure to disposed dredge material the physical interaction between the fish is of most interest, but first we must discuss the characteristics and behavior of the discharge plume and the likelihood of exposure of listed fish and their response to the to the plume.

<u>Discharge field size</u>. The size of the discharge field is primarily determined by the size of the dredge material disposal vessel, the volume of disposal material, the depth of water, and the length of the disposal run, although water depth appears to be the most significant variable in determining overall discharge field size. In-water disposal by hopper dredge or scow will create a discharge field from the bottom of the vessel's hull to the ocean or estuary floor. The depths of

the ODMDS's range from -30 to -205 feet, in-river and in-bay disposal sites range from -10 to -75 feet deep, and the nearshore disposal site at Chetco is approximately -24 feet deep.

During disposal from a hopper dredge, dredged material falls through the water column and mixes with the ambient water to create a plume as part of a process called convective descent. The greatest risk to pelagic fish species occurs when they interact with this descending column of dredged material. The discharge field during each disposal run will vary based on the depth of the disposal site; with the volume of water exposed increasing with depth. Because actual disposal locations within each ODMDS will vary based on site-specific bathymetric conditions at the time of disposal, for the purposes of this consultation, estimates of the volume of water exposed to the convective descent column have been calculated by the Corps for both the *Yaquina* and *Essayons* based on the typical volume of dredged material disposed in 60 feet of water. The beam of the dredge ship Yaquina, the ship primarily used for dredging the Oregon coastal projects, is approximately 58 feet wide. When the depth of the disposal site is -60 feet, the disposal plume will begin at approximately -16 feet (bottom of hull) and be approximately 10 feet in diameter. As the plume descends to the bottom, the radius of the plume will be approximately 92 feet.[6] This discharge field will extend along the travel route. The dredge Essayons, used exclusively at the entrance to Coos Bay, has a 68-foot beam, and while the discharge volume is greater, the discharge field size tends to only increase slightly, with a radius of approximately 16 feet at the bottom of the hull and expanding to 120 feet as it approaches the sea floor.[8]

The amount of dredged and disposed material depends on many factors including the sediment characteristics and dredging conditions. While the specific volume of sediment dredged may vary at any given time because of these variables, the goal of any dredging operation is to work as efficiently as possible to complete the job. Therefore, for the purposes of this consultation, a "typical" volume of dredged material disposed during a single disposal event is considered approximately 800 cy for the *Yaquina* and 4,500 cy for the *Essayons*. The volume of water exposed during disposal of this amount of material then is approximately 25,000 cubic meters (m^3) for the *Yaquina* and 30,000 m^3 for the *Essayons*. The volume of the discharge field size will be smaller at the in-river disposal sites, due to shallower depths at these sites.

<u>Quantity and weight of dredged material</u>. Disposal quantities and discharge time are important variables to consider while assessing the likelihood for OC and SONCC coho salmon juveniles or small subadult southern green sturgeon to be adversely affected through a physical injury from disposal material. For the *Yaquina* hopper dredge the Corps used a value of 800 cy per load as an estimate of a volume in a typical disposal load for the purposes of calculating the volume of water exposed to the disposal plume. A cubic yard of wet sand may weigh as much as 4,000 pounds (lbs). At 800 cy of sand, a maximum of 3,200,000 lbs of material may be discharged during a single event. For the *Essayons*, the Corps used a typical disposal volume of 4,500 cy per trip, therefore a typical maximum of 18,000,000 lbs of material may be discharged during a single event. If a typical load on the Yaquina is discharged over a period of five minutes, this equates to over 10,000 lbs per second of discharge. A typical load on the Essayons, if discharged

[6] Conversation between Rod Moritz, U.S. Army Corps of Engineers (February 3, 2010) and Greg Smith, U.S. Army Corps of Engineers regarding the volume of water associated with the discharge field from the Essayons and Yaquina dredge vessels.

over a period of eight minutes, equates to over 37,000 lbs per second of discharge. The amount and weight of this material is significant for a small fish to resist from being entrained by the descending material and dragged down to the ocean floor. The quantity of dredge material displaces a large volume of water; therefore, if some fish are pushed ahead of the discharge plume they would be entrained within the vortices of the turbulent flow.

Ship detection and avoidance response. For a fish to avoid the disposal material it may first detect and react to the approaching disposal vessel. Early detection and avoidance of a vessel would increase the probability a fish could avoid the disposal material descending around them. Behavior studies related to other water vessels would suggest that unless the juvenile coho salmon are near the surface, they are unlikely to react to a ship passing above them (Satterthwaite 1995). Fernandes *et al.* (2000) contend fish do not avoid survey vessels in their study of vessel avoidance by herring. There is no clear conclusion with this premise based on study results for other species (Gerlotto and Freon 1992; Misund *et al.* 1996, 1993; Jorgensen *et al.* 2004). These other studies observed vertical and horizontal avoidance responses where some fish reacted to the noise of the vessel by diving, others moved horizontally from the noise, and some moved away ahead of the vessel. Based on the conflicting results, not all yearling coho salmon or green sturgeon will react to the vessel and move away from the discharge field.

Avoidance of disposed material. It is unknown whether the coho salmon or green sturgeon will elicit an avoidance response to the disposed material. The Corps (2005) speculates that disposal material would not adversely affect pelagic salmon, but we are not aware of any research or observations documenting yearling coho salmon or green sturgeon response to this material. Coho salmon and green sturgeon individuals will detect the descending material and will attempt to evade the material because they will likely perceive the material as a threat. Based on the observed ship avoidance response research, it is likely initial movement by the fish will be to dive and then initiate horizontal evasion. The determining factor then will be whether the fish can swim fast enough to move out of the discharge field.

Spatial overlap between fish and the discharge field. The distance from the bottom of the hopper dredge to the surface of the water will vary depending on the specific dredge and how loaded the dredge is. The distance the material will descend will change as the Corps discharges the material into the disposal location. Exposure of fish present near the water surface, above the discharge doors, to dredged material will not occur. However, the hopper dredge will start rising as dredge materials are released thereby increasing the area of the discharge field throughout most of the water column. Yearling salmonids are known to use the upper 20 to 25 feet of the water column, although they may also use water column depths ranging from 22 to 37 feet (Carlson *et al.* 2001, Beeman *et al.* 2003). Off of the Oregon coast, yearling coho salmon were collected in surface trawls that sampled from the surface down to 54 feet below the surface (Brodeur *et al.* 2004). Green sturgeon may use various portions of the water column, but are likely at a much deeper depth than the coho salmon. Erickson and Hightower (2007) observed green sturgeon typically occupying depths from 130 to 230 feet, making occasional rapid ascents toward the surface.

At the in-river and in-bay disposal sites, the discharge field size and spatial overlap will be smaller due to shallower depths at these sites. However, these sites are significantly smaller than any of the ODMDS's and it is reasonable to conclude that the entire footprint at any of these sites will be exposed every day that disposal occurs at these locations. Further, when disposal occurs during out-migration of coho salmon smolts, exposure of these fish to disposal events will likely occur due to the constraining channel geometry.

Swimming speed of coho salmon and green sturgeon. Successful avoidance will depend on the swimming speed of the fish, the distance it must travel to get outside the discharge field, and the descent speed of the dredged material. Although the Corps theorizes that the juvenile coho salmon would either avoid the dispersal area or the physics of the disposal plume would displace the fish laterally, no direct evidence supports such an assertion (Corps 2005). The yearling and adult coho salmon "darting" or "burst" swimming speed, the likely response when the disposal material is detected, is estimated at 4 to 5 feet/second and 20 feet/second, respectively (Bell 1990). Bell (1990) estimates the yearling coho salmon swimming speed at about 2.1 feet/second. The darting or burst speed of green sturgeon is unknown. Cruising speed, a sustained swimming speed, for green sturgeon is estimated at 1 body length/second (Niggemyer and Duster 2003). Darting or burst speed would likely be higher than this, possibly twice as fast. Adult green sturgeon captured in various research studies range from 3.9 to 7.4 feet in length (Moser and Lindley 2007; Erickson and Webb 2007). Juvenile green sturgeon may enter the ocean environment when they are 2- to 3-years old and possibly two feet long (Adams *et al.* 2002). Based on the body lengths, burst speed for adult green sturgeon of this reported size would be 8 to 15 feet/second (two body length/second) and four feet/second for small sub-adults.

Relationship between the discharge field and coho salmon and green sturgeon swimming speed. The Corps predicts the initial plume velocity just before impact will reach 11 feet/second. They also predict material last to leave the hopper to have a maximum velocity of 7 feet/second because the slurry mixture would have a greater proportion of neutral buoyant water. With the material descending at 7 to 11 feet/second, in five seconds the plume will descend 35 to 55 feet, and in the shallower disposal locations the material will have already made contact with the bottom of the disposal area. Assuming a central location in the discharge field (29 feet from edge of the field) and direct movement to the edge of the field, adult coho salmon and green sturgeon would have a high likelihood of reaching the edge of the discharge field ahead of the plume due to their speed. Given a darting speed of 20 feet/second, an adult coho salmon will reach the edge of the 58-foot wide field in slightly over 1 second. Larger green sturgeon with burst speeds of 8 to 14 feet/second are also more likely to evade the descending material. These fish, given the same conditions previously described and similar response, will reach the edge of the discharge field in 2 to 3.6 seconds. In 3.6 seconds, the plume will descend 25 to 40 feet.

Conversely, yearling coho salmon or younger and smaller green sturgeon will not likely have the capability of reaching the edge of the disposal plume with just their darting speeds. Small sub-adult green sturgeon may be closer to two feet long. Given their darting speed of approximately four feet/second, it would take a yearling coho salmon or smaller sub-adult green sturgeon 5.8 seconds to traverse to the edge of the plume. The maximum time a fish can sustain a darting speed is 5 to 10 seconds. The yearling coho salmon or smaller sub-adult green sturgeon may not be able to reach the edge of the plume in the allotted time, even if they choose the correct direction and move directly toward the edge. Given that the fish cannot sustain darting speeds for longer than five seconds; the fish may also have to rely on sustained speed to avoid the plume. It would require almost 14 seconds for the fish to reach the edge of the 58-foot wide plume if they started in the center of the plume. In 14 seconds the plume would descend 98 to 154 feet. The ODMDS range in depth from -30 to -205 feet deep, with in-river and in-bay sites as shallow as -17 feet at Coquille, so the plume will hit the floor of the disposal area before a yearling coho salmon or smaller sub-adult green sturgeon could evade. Given these swimming speed challenges and the descent rate of the disposal plume, some yearling coho salmon and smaller sub-adult green sturgeon individuals are not going to be able to avoid the disposal plume. A confounding problem for yearling coho salmon is that they may exhibit schooling behavior, exposing numerous individuals at one time. Therefore, under the circumstances described earlier for adult coho salmon and green sturgeon relative to the characteristics and descent rate of the disposal plume, exposure of yearling OC and SONCC coho salmon and smaller sub-adult green sturgeon to the descending dredged material will occur with significant risk of physical injury to individuals of each species.

Physical interaction between fish and disposed dredged material. The Corps theorizes in their assessment entitled Parameters Describing the Convective Descent of Dredged Material Placed in Open Water by a Hopper Dredge, which was developed by the Corps in March 4, 2005, as an amendment letter to another dredge disposal consultation (refer to NMFS No.: 2004/01041, Corps 2005), that the fish that come into contact with the material and are unable to escape will either resist the material and be exposed to a drag force caused by the material or the fish will not resist and will be displaced by the material plume. If the fish does not resist, the Corps theorized, a boundary layer at the leading edge of the plume would reduce the likelihood of the fish becoming entrained in the material plume. If the fish does become entrained, then the Corps expects the fish will be carried with the plume toward the bottom. In that assessment, the Corps' conclusion for any of the scenarios is that it is unlikely the fish would be adversely affected because the fish would: (1) Allow the material to move around them and only be pulled down by the material but not injured; (2) be pushed ahead of the plume due to a boundary layer and then laterally as the plume reached the ocean floor; or (3) be moved aside by the material. However, a high degree of uncertainty exists regarding the response and risk of fish exposed to disposed materials. Without substantial supporting evidence, the Corps' assessment can be considered representative of possible outcomes, but not all outcomes. We consider that enough uncertainty exists regarding the physical interaction between fish and disposal material that listed species are subject to physical risk. Additional outcomes include a fish being carried along with the downward movement of the sediment and buried under the deposited material and the physical abrasion of their epidermis.

Several adverse physical consequences for yearling coho salmon and smaller sub-adult green sturgeon may occur, even given the Corps' possible outcomes. The Corps' first outcome described above would require individuals to spend a length of time surrounded by dredge material and would result in the respiration of this material past the gills. Very high concentrations of suspended sediments will occur within the water column of the plume. Physical damage to gill membranes is the likely result of this exposure to the material and the subsequent increased probability of indirect effects of disease and infection would lead to increased mortality. The Corps' second and third outcomes described above are also likely to lead to similar adverse physical effects. The fluid dynamics and characteristics of the plume result in significant turbulence of the water along the edge and within the plume. Yearling coho salmon and smaller sub-adult green sturgeon individuals caught in this turbulence and the collapse phase of the discharge field will be entrained in an environment with very high suspended sediment concentrations for a time that would require the fish to respire this damaging sediment. In addition to the gill damage, some individuals are likely to receive abrasion from material passing around them that would remove some of the protective epidermal mucus or when they are forced down to the ocean floor, which is most likely the point where mucus would be removed. Whether individuals are forced into the ocean floor or pushed along the bottom with the collapsing front of the plume, they will likely have physical abrasions that are susceptible to secondary infections. Another possible outcome with these scenarios is the disorientation of individuals caught in the turbulence of the plume. Individuals are likely to be more susceptible to predation due to the disorientation. Exposing yearling coho salmon and smaller green sturgeon to disposed dredged material could result in increased predation or physical harm to the fish from either becoming entrained and buried in the material when it settles on the ocean floor; respiring high concentrations of suspended sediments; being physically abraded by the material; and/or harmed by collision with the bottom substrate. Thus, yearling OC and SONCC coho salmon and sub-adult green sturgeon individuals will suffer injury or death because of these adverse effects.

Number exposed. Accurately determining the number of individual OC and SONCC coho salmon and green sturgeon is difficult because there is no accurate or precise way to count the number of individuals exposed in the area or volume of water adversely affected by disposal with each disposal event. Thus, we must calculate an estimate of individuals injured or killed by exposure to disposed dredged materials.

For in-river sites, disposal occurs at the Tillamook, Umpqua River, Coos Bay, and Coquille River projects. Only at the Umpqua River and Coos Bay sites does this disposal activity overlap with the presence of outmigrating coho salmon smolts. To assess the potential risk of exposure to descending dredged material at flow-lane disposal sites, we used the average number of smolts reaching the lower estuary at these two coastal projects, an estimated typical disposal volume and the number of days needed to dispose of the maximum proposed dredging volume, the number of minutes in a typical disposal event, and an even distribution of fish in a representative cross-sectional area of the disposal site relative to the cross-sectional area of the entire channel, estimated maximum disposal time, and assuming 100% of fish exposed to in-water disposal are adversely affected. An estimated rate of 4.77 OC coho smolts per minute are outmigrating from the Umpqua River during the peak outmigration period and an estimated rate of 3.12 fish per minute and 0.24 fish per minute are outmigrating from Coos Bay during peak and non-peak outmigration periods respectively. Based on the total number of dredge days, typical dredge capacity, estimated trips per day, timing, disposal method, disposal locations, and the potential number of fish likely to be present per disposal activity, up to 101 yearling OC coho salmon could be injured or killed per year at the Umpqua River project and up to 698 yearling OC coho salmon per year at the Coos Bay project due to entrainment during in-river dredged material disposal.

Subadult and adult southern green sturgeon are present in both the Umpqua River and Coos Bay, and considered likely to be present in Tillamook Bay and the Coquille River during the dredging season. We are unable to estimate the number of individual southern green sturgeon adversely affected by this action because no densities or migration rates of green sturgeon from the southern DPS in Oregon's coastal estuaries exist, but we expect this number to be low because migrating green sturgeon appear to spend limited time in one area, southern green sturgeon do not spawn in any of Oregon's coastal rivers; therefore, juvenile green sturgeon will not be present, adult and larger sub-adult green sturgeon will successfully avoid the disposal plumes, and the probability of large numbers of smaller sub-adult green sturgeon present in the in-river disposal sites is unlikely.

For ocean disposal, estimating the number of individual fish injured or killed is difficult because the number of fish in the disposal areas will vary from day-to-day; the number of individuals moving into the site between loads is unknown; and the habitat condition varies from season to season. In addition to habitat condition determining yearling coho salmon abundance, on a daily basis during the months of coho salmon outmigration, smolts will be passing through the action areas to enter the ocean and moving into and through the disposal areas. With the lack of site-specific studies, accurate estimates of the number of OC or SONCC coho salmon or green sturgeon impacted are not possible, but we can estimate them based on assumptions related to abundance, habitat conditions, and reoccupation rates.

To estimate the number of yearling coho salmon exposed to the disposed dredge material at the Oregon coastal project's ocean disposal sites, we used information obtained from Global Ocean Ecosystem Dynamics (GLOBEC) and the Northwest Fisheries Science Center (NWFSC) cruises off the northern California and Oregon coasts to determine relative abundance of coho salmon in the nearshore Pacific Ocean off the coast of Oregon (NWFSC 2000 and 2002). Estimates for small subadult green sturgeon will rely on best judgment based on the use of this area by green sturgeon.

Some of the individuals in the area of disposal will avoid direct exposure to the discharge plume by: (1) Avoiding the ship; (2) randomly being positioned in the action area away from the direct path of the ship; (3) exhibiting some avoidance to the discharge field due to their position in relation to the discharge plume; and (4) being randomly near the edge of the discharge field thereby facilitating avoidance. However, we assumed that all coho salmon directly exposed to the convective descent phase of in-water disposal would be adversely affected, likely leading to mortality for those individual yearling coho salmon caught directly in the plume because they will experience physical harm and death due to this exposure to the discharged dredged sediments.

Based on the NWFSC data an estimated range of 0.0 coho smolts/1,000,000 m^3 (Rogue River trawls) to 45.06 coho smolts/1,000,000 m^3 (Yaquina Bay) may be present in the nearshore Pacific Ocean associated with the coastal projects (NWFSC 2000 and 2002). The estimated maximum number of fish exposed to the Corps' disposal is based on the water volume exposed to a disposal event and the density of coho salmon smolts in the ocean. No evidence exists to provide an assessment as to whether individuals from adjacent ocean areas may move into or out of the ODMDS between disposal loads, whether within the same day or different days. If fish leave the area due to an avoidance of the discharge field, some of these individuals, or others nearby, are likely to reoccupy the disposal site after some short, but uncertain period. It is likely that the longer the time between disposal loads the higher the probability that the ODMDS will be reoccupied to the base abundance. When disposal is occurring during the months when OC and SONCC coho salmon smolts are entering the ocean, there is a higher likelihood these individuals may enter the ODMDS's immediately upon ocean entry. When disposal occurs after most yearling OC or SONCC coho salmon have completed outmigration, individuals may still be present, residing in the nearshore ocean for several months before migrating north (NWFSC 2000 and 2002). Disposal of dredged material from some locations (notably the boat basin access channels) will only occur once every five to eight years.

Assuming that the disposal areas repopulate between loads, the total maximum number of smolt coho salmon exposed to the disposal activities is based on the upper limit number of coho salmon that could occupy an ODMDS multiplied by the number of disposal loads that occurs at each ODMDS. This assumption is based on the expectation that the turbidity plume and the ship activities related to disposing the material will not dissuade fish from moving back into the area between loads. While it is unknown how many coho salmon would move into the action area after each daily operation, reoccupation could occur at a high level. For the purpose of this analysis, we assumed the highest abundance level of smolts entering the action area.

Some variability is evident in the number of coho salmon smolts exposed and injured or killed by disposal of dredged material. In 2000, more coho salmon smolts were captured in the trawls in August than June (Brodeur *et al.* 2004). In the combined data reviewed for the two years of trawl data, the abundance of coho salmon smolts varied and for most stations, the average abundance was highest during June (NFWSC 2000, 2002). For this analysis, we considered the June densities represented the highest abundance based on the outmigration of coho smolts from the rivers and the combined two years of ocean trawl data. It is likely that fewer coho salmon will be exposed in September and October when the majority of coho salmon smolts have migrated north. Table 20 summarizes the range of exposure and the number of OC or SONCC coho salmon smolts potentially injured or killed at each of the coastal projects. This variability is driven by differences in the volume of material scheduled for ocean disposal and the relative abundance of coho salmon off the northern California and Oregon coast. For the Yaquina Bay, Coquille River, Rogue River, and Chetco River, additional dredging will occur every five to eight years. The additional volume of material is relatively small and does not significantly increase the number of coho salmon yearlings potentially exposed to disposal of dredged material because of increased disposal volume.

Table 20. Estimated number of coho salmon exposed to ocean disposal of dredged sediments at the Corps' Coastal Projects.

Project	Number of annual loads	Number of loads every 5 to 8 years	GLOBEC* data (fish/m^3)	Number of smolts exposed annually	Number of smolts exposed every 5 to 8 years
Tillamook	NA	NA	NA	NA	NA
Depoe	NA	NA	NA	NA	NA
Yaquina	563	156	45.06	634	176
Siuslaw	222	222	6.07	19	19
Umpqua	344	NA	12.55	108	NA
Coos Bay	1911	NA	3.12	153	NA
Coquille	63	15	3.12	4	1
			Total OC	**918**	**196**
Port Orford	NA	NA	NA	0	NA
Rogue	325	188	0.75	3	2
Rogue AMD Gravel Bar (2021 only)	500	NA	0.75	5	NA
Chetco	156	20	0.75	2	1
			Total SONCC	**5**	**3**

*NWFSC 2000 and 2002 trawl data

The maximum dredging volume and dredge days was provided by the Corps based on their records, with this maximum level of dredging effort only occurring once in the last 10 years. The number of disposal loads to complete dredging operations was based on an estimated volume of 800 cy per load for the *Yaquina* and 4,500 cy per load for the *Essayons*. Because of year-to-year variability for material the Corps needs to be dredged from the navigation channels, an assessment of the impacts from the potential maximum was necessary. Therefore, it is unlikely that the estimated number of individuals exposed and/or killed in any one year would continue year after year, but rather, would most likely only occur once in the next 10 years.

The number of green sturgeon present in the entire southern DPS is unknown (Adams *et al.* 2007), therefore, the abundance of the green sturgeon within each of the ODMDS's is unknown but likely to be very low. Lindley *et al.* (2008) tracked the migrating tagged green sturgeon along the west coast (Figure 18). It is apparent green sturgeon are migrating along the Oregon coast, but whether they actually enter each of the ODMDS's is unknown. While green sturgeon are known to use the larger coastal bays and estuaries on the Oregon coast (*e.g.* Coos Bay and Winchester Bay), it is unknown to what extent southern green sturgeon use the smaller bays and estuaries. In addition to their exact location, these migrating fish are likely moving through the area at a high rate of speed (Lindley *et al.* 2008) and will not likely to stay within an individual action area very long. The most likely migration scenario where green sturgeon might enter the action area would be for green sturgeon that are headed into one of the Oregon coastal projects' bay or estuary. We are unable to accurately estimate the number of green sturgeon adversely affected by this action, but expect this number to be low because: (1) Based on limited information, few green sturgeon use Oregon's coastal bays and estuaries; (2) migrating green sturgeon spend limited time in one area as they move from estuary to estuary and are possibly further offshore; (3) the majority of green sturgeon are in more northern bays and estuaries; and (4) green sturgeon do not spawn in any of Oregon coastal river basins, and therefore, small juvenile green sturgeon will not be present. Nonetheless, injury or death will likely occur to some smaller subadult green sturgeon if they occur at an ODMDS at the time of the material disposal.

Work area isolation and fish salvage

Prior to any dredging at the Depoe Bay sediment check dam the Corps will implement a work area isolation and dewatering plan (Section 6.1 Appendix A). The Corps will isolate the work area using a cofferdam, conduct fish salvage, and slowly dewater the isolation area. Any individual fish present in the work isolation area would be captured and released. Fish that are transferred to holding tanks can experience trauma if care is not taken in the transfer process, and fish can experience stress and injury from overcrowding in traps, if the traps are not emptied on a regular basis. Stress and death from handling occur because of differences in water temperature and dissolved oxygen between the river and transfer buckets, as well as physical trauma and the amount of time that fish are held out of the water. Stress on salmon and steelhead increases rapidly from handling if the water temperature exceeds 64ºF, or if dissolved oxygen is below saturation. Debris buildup and predation within minnow traps can also kill or injure listed fish if they are not monitored and cleared on a regular basis. Conservation measures related to the capture and release of fish during work area isolation (Appendix 6.1) will avoid most of these consequences, and ensure that most of the resulting stress is short-lived.

NMFS anticipates that up to 29 individual OC coho salmon would be captured during work area isolation and fish salvage.[7] Of these up to two individual OC coho salmon juveniles would be killed by isolation and salvage activities. Capture and killing of OC coho salmon juveniles will occur every 5 to 8 years, thus isolation and salvage will not affect consecutive year classes of OC coho salmon.

Summary of effects to ESA-listed species

Exposure of OC and SONCC coho salmon smolts to dredging will occur as they pass through each of the project areas on their way to the ocean. The proposed conservation measures for dredging will reduce the probability of death of OC and SONCC coho salmon smolts exposed to dredging. However, annual entrainment during dredging of a small number of OC (151) and SONCC (18) coho salmon smolts during dredging will occur. The impact to abundance will be spread across seven populations of OC coho salmon and the Rogue River population for SONCC coho salmon (Table 21). Exposure of adult OC and SONCC coho salmon and adult and sub-adult green sturgeon will likely occur, but they are unlikely to be killed because they can easily avoid the hydraulic cutterhead and pipeline dredges without experiencing any adverse effects.

[7] In 2007, ODOT completed 36 work area isolation operations involving capture and release using nets and electrofishing; 12 of those operations resulted in capture of 0 Chinook salmon, 345 coho salmon, and 22 steelhead; with an average mortality of 5% Cannon (2008). Cannon (2012) reported a mortality rate of 4.4% for 455 listed salmon and steelhead captures during 30 fish capture and release operations in 2012. No sturgeon or eulachon have been captured because of ODOT fish capture and operations.

Table 21. Populations of OC and SONCC coho salmon impacted by entrainment during dredging.

ESU	Population	Number of coho salmon
OC coho salmon	Yaquina	32
	Siuslaw	19
	Umpqua*	71
	Coos	29
SONCC coho salmon	Rogue	18

*Consists of the Lower, Middle, North, and South Umpqua populations.

Disposal of dredged material at the in-river disposal sites and the ODMDS's will result in injury or death of OC and SONCC coho salmon smolts and smaller sub-adult green sturgeon because they cannot swim fast enough to successfully evade the material descending through the water column. Injury or death of OC and SONCC coho salmon and sub-adult green sturgeon individuals will occur from increased predation or physical harm to the fish from either becoming entrained and buried in the material when it settles on the ocean floor; respiring high concentrations of suspended sediments; being physically abraded by the material; and/or harmed by collision with the bottom substrate. The annual total number of OC and SONCC coho salmon injured or killed by entrainment during in-river and ocean disposal is 1,717 and 5 (10 in 2021 because of the AMD gravel bar). Every 5 to 8 years, ocean disposal will injure or kill an additional 196 OC coho salmon and 2 SONCC coho salmon. Individuals injured or killed at the ODMDS's will be from multiple populations of OC and SONCC coho salmon.

Suspended sediment increases in the boat basin access channels and the up-river areas caused by mechanical dredging will injure or kill a small number of juvenile OC or SONCC coho salmon every 5 to 8 years. Thus, the impacts of the proposed action will not occur on any consecutive year classes of any of the affected populations.

While some smaller sub-adult green sturgeon will be injured or killed by dredged material disposal, the number is likely low because migrating green sturgeon spend limited time in one area as they move from estuary to estuary and are possibly further offshore, the majority of green sturgeon are in more northern bays and estuaries, adult and larger sub-adult green sturgeon will successfully avoid the disposal plumes, and green sturgeon do not spawn in any of Oregon coastal river basins, and therefore, small juvenile green sturgeon will not be present.

When we combine the probability of exposure of OC and SONCC coho salmon and green sturgeon together with the sensitivity of each life stage to the effects of the proposed action, we find that the proposed action will affect populations of OC and SONCC coho salmon and the southern DPS of green sturgeon. To determine the level of impact at the population level we have to analyze the OC and SONCC coho salmon ESU's and the southern DPS of green sturgeon separately because of the differences in their population structures and data availability.

OC coho salmon. All populations except the Depoe Bay population of OC coho salmon considered in this opinion are independent populations, which are important to the conservation of the OC coho salmon species. While those individual OC coho salmon injured or killed by entrainment and in-river disposal can be estimated to determine an impact at the population level, it is more difficult to accurately determine the impact to the populations of OC coho salmon from ocean disposal when individuals from multiple populations will likely be exposed and affected or from increased suspended sediments where there is no data on densities of coho salmon in the boat basin access channels or up-river dredged areas. However, we are reasonably certain that the majority of individuals present in the ODMDS's are from the population or populations of the river associated with each ODMDS. Thus, the greatest impact that could occur at the population level is if all individuals at an ODMDS injured or killed by disposal were from the population or populations associated with each ODMDS. We can estimate the greatest impact to each population by comparing the number of individuals injured or killed by entrainment, in-river disposal, ocean disposal, and suspended sediments in each population to the 10-year average of population abundance. To accommodate those individuals injured by suspended sediments in the jeopardy analysis for this proposed action we will add a number of individuals that is equal to 10% of the number of individuals injured by entrainment from dredging and disposal every 5 to 8 years. This is likely an overestimate of the number of individuals injured from this effect, but it is a reasonable assumption based on the nature of the effect, the location where the effect will occur, and the likely response of coho salmon individuals when exposed to this effect.

To estimate the impact at the population level we must first calculate an adult equivalent of the number of smolts injured or killed by ocean disposal at each project estuary using a marine survival estimate. Using this estimate we can compare this to the 10-year average population abundance (Table 22).

Table 22. Effect to OC coho salmon populations resulting from the proposed action.

ESU	Population	Number of coho killed annually[a]	Number of coho killed 5 to 8 years	Adult equivalent[a]	10-year average adult abundance	Percent of population injured or killed
OC coho salmon	**Tillamook**	0	NA	NA	9,381	NA
	Depoe Bay	Unknown	Unknown	Unknown	Unknown	Unknown
	Yaquina	666	926	14/20	7,981	0.175/0.25%
	Siuslaw	38	63	1/2	15,816	0.006/0.012%
	Lower Umpqua	280	N/A	6	12,692	0.05%
	Middle Umpqua	280	N/A	6	7,093	0.09%
	North Umpqua	280	N/A	6	3,748	0.17%
	South Umpqua	280	N/A	6	12,462	0.051%
	Coos	880	N/A	19	12,475	0.155%
	Coquille	4	6	1/1	18,546	0.005/0.005%

[a]The second number represents the adult equivalent every 5 to 8 years.

The annual proportion of the number of OC coho salmon injured or killed by the proposed action ranges from 0.004% to 0.175%, while every 5 to 8 years the range is from 0.005% to less than 0.25%. The injury or death of such a small proportion of individuals from each population will result in effects that are not meaningful to the population abundance, productivity, diversity, or distribution of any of these populations. Therefore, the proposed action will not adversely affect the sustainability or persistence of any of the affected populations in the OC coho salmon ESU.

SONCC coho salmon. The Elk; Lower, Middle, Illinois, and Upper Rogue; and Chetco Rivers populations are core and non-core (Lower and Middle Rogue), which are all important for the conservation and recovery of the SONCC coho salmon ESU. Dredging and ocean disposal will injure or kill individuals from all the Rogue and Chetco River populations. The abundance of SONCC coho salmon populations in Oregon have not been as extensively studied as those of OC coho salmon, thus limited data are available for the Oregon populations of SONCC coho salmon. The best data sets that are available are the Huntley Park seine of naturally produced coho salmon spawner abundance in the Rogue River basin, incorporating all four populations. However, it is impossible to determine, with existing information, how many of the estimated coho salmon at Huntley Park are returning to an area occupied by a specific Rogue River population. Since 1980, wild coho salmon abundance in the Rogue River basin has ranged from 314 to 24,509 spawners with an average over the last 10 years of 5,263. Entrainment and ocean disposal at the Rogue River project will injure or kill 21 juvenile coho salmon annually and 23 juvenile individuals every 5 to 8 years. The proportion of the total Rogue River basin spawner abundance in each of these scenarios is 0.04% and 0.044%,[8] respectively. Furthermore, these proportions will be spread out over the Lower, Middle/Applegate, Illinois, and Upper Rogue River populations, thus the effect to each individual population is not meaningful.

For the Chetco River population, the only available data on coho salmon spawner returns comes from the ODFW Chinook salmon spawning surveys (1998-2012) which occasionally document coho salmon (Table 22).[9] Because coho salmon were not the target of the surveys their geographic scope misses a lot of the coho spawning grounds and coho salmon may not occur at the same times as that of Chinook salmon (NMFS 2014). Thus, the data does not very accurately represent the abundance of SONCC coho salmon in the Chetco River. Nonetheless, this is the best information available to determine the effect on the population. The best available information suggests the average annual return of Chetco River spawners is likely below the depensation threshold of 135 fish (NMFS 2014). When a population is under this threshold, recovery will be slow (due to density dependent variables like finding mates), but depensation does not mean recovery is unattainable (Liermann and Hilborn 2001), (NMFS 2014). Because the fecundity of coho salmon is high (2,500 to 5,000 eggs per female, Beacham 1982, Sandercock 1991) it does not take many spawners finding each other to translate into increased numbers of juveniles. The average annual estimate from the ODFW data is 148 spawners per year. Ocean disposal at the Chetco River project will injure or kill two coho salmon individuals annually and four individuals every 5 to 8 years. The proportion of the total Chetco River basin

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[8] These proportions were calculated using an estimated marine survival rate to calculate the number of adult equivalents from the number of juvenile SONCC coho salmon. A 10% marine survival rate was used as cited in the SONCC coho salmon recovery plan (NMFS 2014), which states, “In general, coho salmon marine survival is about 10% (Bradford 1995), although there is a wide range in survival rates (from less than 1% to 21%) depending on population location and ocean conditions (Beamish *et al.* 2000; Quinn 2005).”

[9] E-mail from Todd Confer, Oregon Department of Fish and Wildlife, to Chuck Wheeler, NMFS (June 10, 2013) (attaching Rogue Watershed District estimates of annual spawning escapement of coho salmon spawning in the coastal strata of the Oregon portion of the SONCC coho salmon recovery domain, 1998-2012).

spawner abundance in each of these scenarios is 0.14% and less than 0.27%.[10] Therefore, the effect of the proposed action on the Chetco River population is not meaningful.

Because the effects of the proposed action are not meaningful to the abundance, productivity, diversity, and distribution of the Rogue River populations and the Chetco River population, the proposed action will not adversely affect the persistence or sustainability of these populations or the SONCC coho salmon ESU.

Green sturgeon. The proposed action will injure or kill smaller sub-adult green sturgeon because of exposure to dredged material disposal. While we cannot estimate the number green sturgeon injured or killed by disposal, the number will be low because they do not spawn in Oregon's coastal rivers and they will be quickly migrating through and will not spend a significant amount of time in the disposal areas, minimizing their risk of exposure. The effects on abundance and productivity at the population scale will be minor because disposal will injure or kill such a small number of individuals. Therefore, effects on abundance, productivity, diversity, or distribution will not be measurable or meaningfully expressed at the population scale.

2.6. Cumulative Effects

"Cumulative effects" are those effects of future state or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation (50 CFR 402.02 and 402.17(a)). Future Federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to section 7 of the ESA.

Some continuing non-Federal activities are reasonably certain to contribute to climate effects within the action area. However, it is difficult if not impossible to distinguish between the action area's future environmental conditions caused by global climate change that are properly part of the environmental baseline *vs.* cumulative effects. Therefore, all relevant future climate-related environmental conditions in the action area are described in the environmental baseline (Section 2.4).

The contribution of non-Federal activities to the current condition of ESA-listed species and designated critical habitats within the estuarine action area was described in the Status of the Species and Critical Habitats and Environmental Baseline sections, above. Among those activities were agriculture, forestry, road construction, urbanization, grazing, and gravel mining. Those actions were driven by a combination of economic conditions that characterized traditional natural resource-based industries, and general resource demands associated with settlement of population centers in the estuarine action area.

For this analysis, the coastal marine action area includes vessel traffic unrelated to the proposed action. Vessel traffic is likely to continue, but we have no information whether it will increase or decrease. Activities that may occur in these areas will likely consist of state government actions related to ocean use policy and management of public resources, such as fishing or energy

[10] Ibid footnote 8.

development projects. Changes in ocean use policies are too uncertain and may be subject to sudden changes as political and financial situations develop.

Resource-based activities that affect the action area such as forestry, agriculture, gravel mining, urbanization, road building, fishing, vessel traffic, and energy developments are reasonably certain to continue and exert an influence on habitat quality in the action area as a whole. However, the adoption of industry-wide standards to reduce environmental impacts and the shift away from resource extraction to a mixed economy should result in a gradual decrease in influence over time. Offsetting this decline will be human population growth. The human population of Oregon is expected to increase in the next several decades with a corresponding increase in natural resource consumption. A general increase in human activities is expected to cause slow, but incremental degradation to estuarine and marine habitats in the action area.

In contrast, environmental awareness is increasing among the public and, to a certain degree, industry, which is resulting in the conducting of activities and resource consumption in a manner that is more favorable to our environment. However, in considering all the aforementioned influences collectively, we expect habitat trends to remain flat or continue to slowly decline as population growth increases and the effects of climate change continue. At best, this habitat trend will have a neutral effect on population abundance and productivity for the species considered in this consultation. The worst-case scenario would be that cumulative effects would have a slight negative effect on population abundance and productivity. Similarly, we expect the quality and function of critical habitat PBFs to express a flat or slightly negative trend over time because of cumulative effects.

2.7. Integration and Synthesis

The Integration and Synthesis section is the final step in our assessment of the risk posed to species and critical habitat as a result of implementing the proposed action. In this section, we add the effects of the action (Section 2.5) to the environmental baseline (Section 2.4) and the cumulative effects (Section 2.6), taking into account the status of the species and critical habitat (Section 2.2), to formulate the agency's biological opinion as to whether the proposed action is likely to: (1) Reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing its numbers, reproduction, or distribution; or (2) appreciably diminish the value of designated or proposed critical habitat as a whole for the conservation of the species.

2.7.1 Critical Habitat

Oregon Coast coho salmon, SONCC coho salmon, and green sturgeon have designated critical habitat in the action area. The value of PBFs for their critical habitats have declined because of numerous management and use activities, mostly related coastal and estuarine development. For OC and SONCC coho salmon, habitat-limiting factors include extensive loss of access to habitats and habitat changes resulting from land use management. For green sturgeon, habitat-limiting factors include degraded water and substrate quality and reduced food resources.

Agriculture, forestry, grazing, roads, urbanization, and gravel mining have degraded the environmental baseline of the estuarine action area. Many of the changes to critical habitat resulting from these management activities over the last 150 years have stabilized, but continue to hinder recovery of the populations. Restoration activities in some of the project estuaries have gained popularity in recent decades. Restoration actions may have short-term adverse effects, but generally result in long-term improvements to critical habitat conditions. The coastal marine action area is designated critical habitat for green sturgeon. Habitat quality varies from year to year depending on the large-scale ocean dynamics that determine nutrient upwelling and water quality conditions. The environmental baseline in the coastal marine action area has been degraded by past human uses, such as ommercial and recreational fishing, oceanographic research and monitoring, and commercial and recreational vessel traffic. Climate change is reasonably certain to exacerbate degraded conditions in the action area in particular, increased water temperatures and decreased summer flows in the estuarine analysis area, and ocean acidification and sea level rise in the marine and estuarine analysis areas.

As described in the analysis of effects of the action, the proposed action will result in adverse effects on OC coho salmon, SONCC coho salmon, and green sturgeon designated critical habitat because of dredging and disposal of dredged materials in the project estuaries and dredged material disposal sites. The adverse effects will be minor, short-term, or localized to a small portion of the affected critical habitat.

Cumulative effects from future state and private activities are reasonably certain to have a neutral to slightly negative effect over time on the critical habitats considered in this opinion. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. We expect the public's growing environmental awareness will reduce the impacts of some activities affecting critical habitat. Nonetheless, NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, the trend of critical habitat PBFs would remain the same or continue to slowly degrade from these cumulative effects.

The effects of the proposed action, when added to the environmental baseline, cumulative effects, and status of OC coho salmon, SONCC coho salmon, and green sturgeon critical habitat will not appreciably reduce the quality and function of critical habitat in the action area. Therefore, the action will not impair the ability of this critical habitat to play its intended conservation role of supporting populations of OC and SONCC coho salmon and green sturgeon in the action area.

2.7.2 ESA-listed Species

The status of OC and SONCC coho salmon and green sturgeon varies considerably from high risk to moderate risk. Similarly, the individual populations within the OC and SONCC coho salmon ESUs and green sturgeon DPS affected by the proposed action vary considerably in their biological status. The species addressed in this opinion have declined due to numerous factors. One factor for decline of all species addressed in this opinion is degradation of their habitat. Habitat alteration has caused significant negative changes to riverine and estuary habitat quality.

Species in the marine analysis areas share factors related to vessel traffic associated with shipping and fishing.

Forestry, agriculture, grazing, gravel mining, and urbanization have negatively affected the baseline in the estuarine action area by reducing estuarine habitat quality and availability. Commercial and recreational fishing, oceanographic research and monitoring, and commercial and recreational vessel traffic have negatively affected the environmental baseline of the marine action area. Climate change will likely exacerbate these degraded habitat conditions in the action area, in particular degraded water quality and habitat quality in the estuarine action area and increased ocean temperatures, ocean acidification, and sea level rise in the marine action area.

As described in the analysis of the effects of the action, the proposed action is reasonably certain to harass, injure, or kill individual OC coho salmon, SONCC coho salmon, and green sturgeon because of dredging, disposal of dredged material, and work area isolation and fish salvage (Depoe Bay population of OC coho salmon only). The number of individuals harassed, injured, or killed relative to the affected populations in each species is small and will not meaningfully or measurably change population-level characteristics (i.e, spatial structure, diversity, abundance, and productivity).

Cumulative effects from future state and private activities are reasonably certain to have a neutral to slightly negative effect over time on OC and SONCC coho salmon and green sturgeon. As population continues to grow in and surrounding the action area, so does the overall consumption of local and regional natural resources. We expect the public's growing environmental awareness will reduce the impacts of some activities on each species. Nonetheless, NMFS assumes that future private, state, and federal actions would continue within the action areas, increasing as population rises. Because of this, population abundance and productivity trends would remain the same or continue to slowly degrade from these cumulative effects.

At the OC and SONCC coho salmon ESU scales, the status of individual populations determines the ability of the species to sustain itself or persist well into the future, thus impacts to individual populations are important to the survival and recovery of the species. Because the adverse effects caused by the proposed action are small in scale and in numbers of the fish per population affected, when we add them to the current population status, environmental baseline, and consider cumulative effects and climate change, we find the proposed action will not appreciably reduce the likelihood of the survival or recovery of OC or SONCC coho salmon at the population scale for any of the affected populations. Given our conclusion that the populations will not be impeded in recovery because of the proposed action, it will also not appreciably reduce the likelihood of the survival or recovery of OC or SONCC coho salmon species.

The DPS of green sturgeon contains one population. Because the adverse effects caused by the proposed action are minor, short-term, and/or localized, when we add them to the current population status, environmental baseline, and consider cumulative effects and climate change, we find the proposed action will not appreciably reduce the likelihood of the survival or recovery of the Sacramento River spawning population of green sturgeon. Because the population is the sDPS, the proposed action will also not appreciably reduce the likelihood of the survival or recovery of southern DPS green sturgeon.

2.8. Conclusion

After reviewing and analyzing the current status of the listed species and critical habitat, the environmental baseline within the action area, the effects of the proposed action, the effects of other activities caused by the proposed action, and cumulative effects, it is NMFS' biological opinion that the proposed action is not likely to jeopardize the continued existence of OC coho salmon, SONCC coho salmon, or southern DPS green sturgeon or destroy or adversely modify their designated critical habitats.

2.9. Incidental Take Statement

Section 9 of the ESA and Federal regulations pursuant to section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. "Take" is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or to attempt to engage in any such conduct. "Harm" is further defined by regulation to include significant habitat modification or degradation that actually kills or injures fish or wildlife by significantly impairing essential behavioral patterns, including breeding, spawning, rearing, migrating, feeding, or sheltering (50 CFR 222.102). "Incidental take" is defined by regulation as takings that result from, but are not the purpose of, carrying out an otherwise lawful activity conducted by the Federal agency or applicant (50 CFR 402.02). Section 7(b)(4) and section 7(o)(2) provide that taking that is incidental to an otherwise lawful agency action is not considered to be prohibited taking under the ESA if that action is performed in compliance with the terms and conditions of this ITS.

2.9.1 Amount or Extent of Take

In the biological opinion, NMFS determined that incidental take is reasonably certain to occur as follows:

1. Injury or death will occur to OC coho salmon smolts from entrainment and exposure to suspended sediments during dredging, exposure to dredge material during in-river and ocean disposal, and work area isolation and fish salvage (Depoe Bay sediment check dam).
2. Injury or death will occur to SONCC coho salmon smolts from entrainment and exposure to suspended sediments during dredging and exposure to dredged material during ocean disposal.
3. Injury or death will occur to smaller sub-adult green sturgeon from exposure to dredged material during in-river and ocean disposal.

For work area isolation and fish salvage at Depoe Bay sediment check dam, we estimated the amount of take because of capture or killing at 29 OC coho salmon individuals. If take because of work area isolation and fish salvage at the Depoe Bay sediment check dam exceeds 29 individuals captured or killed, the reinitiation of consultation for this proposed action will be warranted.

For the purposes of the jeopardy analysis, we estimated the number of OC and SONCC coho salmon injured or killed by entrainment and dredged material disposal; however, there is no feasible way to directly observe and count individual fish injured or killed by entrainment or exposure to dredged materials during disposal. We are not aware of any existing device or practicable technique that would allow safe observation during dredging and disposal operations while yielding reliable counts. In such cases, we use a take surrogate or take indicator that rationally reflects the incidental take caused by the proposed action.

For take of OC and SONCC coho salmon associated with entrainment the best available indicator for the extent of take is one that best describes the dredging efforts relative to the amount of materials dredged at each project dredging location. The extent of take for entrainment is the volume of material dredged at each project site where take from entrainment would occur. This indicator is appropriate for this proposed action because it is directly related to the quantitative magnitude of take caused by entrainment during dredging. The volume of materials proposed for dredging at each proposed dredging location where entrainment will occur is shown in Table 23. If the Corps exceeds the volume of material dredged at these project locations, reinitiation of consultation of this proposed action will be warranted.

Table 23. Dredged material volumes at project locations where individual OC and SONCC coho salmon will be subject to entrainment.

Project	Amount of Material (cy)
OC coho salmon	
Yaquina Bay	575,000
Siuslaw River	200,000
Umpqua River	275,000
Coos Bay	2,350,000
SONCC coho salmon	
Rogue River (2021)	450,000
Rogue River (annually, post 2021)	205,000

For take of OC and SONCC coho salmon associated with increased suspended sediments during dredging, the best available indicator for the extent of take is one that best describes the number of work stoppages that occur during dredging at a single project area.[11] This indicator is appropriate for this proposed action because it is easily measured and directly related to the quantitative magnitude of take caused by increased suspended sediments during mechanical dredging. If dredging operations in three or more of the locations listed in Table 2 exceed four work stoppages during a single dredging season due to increased suspended sediments, reinitiation of consultation on the proposed action will be warranted.

For take of green sturgeon, OC coho salmon, and SONCC coho salmon associated with dredged material disposal, the best available indicator for the extent of take is one that best describes the

[11] Work stoppages result when suspended sediments resulting in turbidities of (1) 30 NTUs above background for two consecutive two-hour samples for fine-grained sediments; (b) 50 NTUs or more above background for any sample, or (c) for coarse-grained sediments, continues to exhibit plainly apparent changes in water color or clarity (discernable by visual observation) after the application of corrective measures.

disposal effort relative to volume of material dredged and the number of disposal loads associated with each project site where take associated with disposal of dredged material will occur. This indicator requires both volume and the number of loads because past monitoring of dredged material volumes and number of disposal loads has shown that the number of loads can be exceeded without the exceedance of material volume at a project site. This indicator is appropriate for this proposed action because it is directly related to the quantitative magnitude of take caused by dredged material disposal. The volume of materials and number of loads at each proposed dredging location where take from dredged material disposal will occur is shown in Table 24. If the Corps exceeds the volume of material and number of loads at one of these project locations, reinitiation of consultation of this proposed action will be warranted.

Table 24. Dredged material volumes and disposal loads where individual OC and SONCC coho salmon and green sturgeon will be exposed to dredged material disposal.

Project	**Volume of material (cy)**		**Number of disposal loads**	
	Annually	**5 to 8 years**	**Annually**	**5 to 8 years**
Yaquina Bay	450,000	575,000	563	719
Siuslaw River	100,000	200,000	125	250
Umpqua River	275,000	N/A	344	N/A
Coos Bay	2,350,000	N/A	1911	N/A
Coquille River	38,000	47,000	63	78
Rogue River (2021 only)	405,000	N/A	1,013	N/A
Rogue River (annually, post 2021)	130,000	205,000	325	513
Chetco River	70,000	79,000	156	176

2.9.2 Effect of the Take

In the biological opinion, NMFS determined that the amount or extent of anticipated take, coupled with other effects of the proposed action, is not likely to result in jeopardy to OC coho salmon, SONCC coho salmon, green sturgeon, or destruction or adverse modification of their critical habitats.

2.9.3 Reasonable and Prudent Measures

"Reasonable and prudent measures" are nondiscretionary measures that are necessary or appropriate to minimize the impact of the amount or extent of incidental take (50 CFR 402.02).

1. Minimize incidental take from dredging.
2. Minimize incidental take from exposure to dredged material disposal.
3. Minimize incidental take from suspended sediments.
4. Conduct monitoring during dredging and disposal to document the effects of the proposed action on listed species in the action area. Provide monitoring reports to NMFS.

2.9.4 Terms and Conditions

The terms and conditions described below are non-discretionary, and the Corps or any applicant must comply with them in order to implement the RPMs (50 CFR 402.14). The Corps or any applicant has a continuing duty to monitor the impacts of incidental take and must report the progress of the action and its impact on the species as specified in this ITS (50 CFR 402.14). If the entity to whom a term and condition is directed does not comply with the following terms and conditions, protective coverage for the proposed action would likely lapse.

1. The following terms and conditions implement reasonable and prudent measure 1:
   a. The dredge operator will confine the dredge prism to the minimum area necessary to achieve project goals and the resulting depth of the entrance channel will not be deeper than the authorized project depth including advanced maintenance and overdepth.
   b. Dredge dragheads and/or cutterheads shall not exceed three feet above the bottom of the channel with the dredge pumps running more than three times per eight hours of dredging at the Yaquina Bay, Siuslaw River, Umpqua River, Coos Bay, and Rogue River Projects.

2. The following terms and conditions implement reasonable and prudent measure 2:
   a. Increases in suspended sediments shall not result in four work stoppages at three or more of the locations listed in Table 2 during a single dredging season. The Corps shall complete monitoring of suspended sediments by monitoring the turbidity when dredging in areas of fine-grained sediments (equal to, or greater than, 20% silts/clays) as follows:
      i. For fine-grained sediments, use an appropriate and regularly calibrated turbidimeter to quantify change as nephlometic turbidity units (NTUs).
      ii. In areas with coarse-grained sediments, use visual observation to determine if there is significantly detectable change.
      iii. Each sample consists of a visual observation or a turbidimeter reading, made at a baseline site upcurrent of each work area, and a corresponding reading or observation made downcurrent of each work area. Establish a baseline and a compliance site for each work area as follows:
         1) Select a baseline site at a relatively undisturbed area approximately 200 feet upcurrent from each work area and make a surface observation (for visual monitoring) or take a sample at approximately mid-depth (when using a turbidimeter) and within any visible plume to determine background turbidity. Record the location of the baseline site, the date, time of day, tidal stage of the turbidity sample, and the turbidity before monitoring downstream. Note any other relevant sampling conditions (e.g., weather, river stage, upstream activity, onsite activity).
         2) Select a compliance site approximately 200 feet down current of the designated point and make a surface observation (for visual monitoring) or take a sample at approximately mid-depth (when using a turbidimeter) and within any visible plume to compare with the baseline. Record the location of the compliance site, the date, time, and tidal stage of the turbidity sample, and the turbidity. Note any other relevant sampling conditions.

iv. Conduct compliance tests by comparing results from the baseline and compliance sites for each sample to determine whether turbidity increased below the work area.

1) If turbidity increased to any visible extent (plainly apparent changes in water color or clarity), continue to monitor every two hours and carry out BMPs or other corrective action as necessary to reduce turbidity, including any work necessary to repair, replace or reinforce sediment controls. BMPs to minimize sediment disturbance and distribution through the water column include, but are not limited to, the following:
   a) Sequence or phase work activities to minimize the extent and duration of in-water disturbances.
   b) Employ and experienced equipment operator.
   c) Use bucket control techniques, such as:
      (i). Do not overfill the bucket.
      (ii). Close the bucket as slowly as possible on the bottom.
      (iii). Pause before hoisting the bucket off of the bottom to allow any overage to settle near the bottom.
      (iv). Hoist load very slowly.
      (v). If is permissible, pause bucket at water surface to minimize distance of discharge.
      (vi). Slam open the bucket after material is dumped on a barge to dislodge any additional material that is potentially clinging to the bucket.
      (vii). Ensure that all material has dumped into the barge from the bucket before returning for another bite.
      (viii). Do not dump partial or full buckets of material back into the wetted stream.
      (ix). Vary the volume, speed, or both of digging passes to minimize siltation to the maximum extent practicable.
2) Stop work for the remainder of the 24 hour period if turbidity reaches any of the following thresholds:
   a) 30 NTUs above background for two consecutive two-hour samples for fine-grained sediments.
   b) 50 NTUs or more above background for any sample.
   c) For coarse-grained sediments, continues to exhibit plainly apparent changes in water color or clarity (discernable by visual observation) after the application of corrective measures.
3) If any dredging operations in any of the locations exceed two cease work events during a single dredging season due to turbidity, the Corps must provide additional BMPs, change operations, or both in order to reduce sediment disturbances and distribution.
4) Prepare and submit a summary of the turbidity monitoring, including a photograph of the baseline and compliance sites; a copy of turbidity measurements or observations with the date and time that each was taken; other relevant sampling conditions; and description of any sediment

control failure, sediment release, correction efforts, BMPs attempted, and any time work was stopped or restarted.

3. The following terms and conditions implement reasonable and prudent measure 3:
   a. Abstain from disposing of dredged material at the Umpqua River and Coos Bay in-river disposal sites during the months of April through June.
   b. Dredge the minimum amount of materials necessary to minimize the number of disposal loads while still achieving project goals.
   c. Monitor the number of disposal loads and volume of dredged material disposed of at the in-river disposal sites and ODMDS's. Report them annually to NMFS.
   d. Create a beneficial uses program to utilize gravel and/or other material to minimize the number of disposal loads and volume of dredged material disposed of at the in-river disposal sites and ODMDS's. Report on progress annually.

4. The following terms and conditions implement reasonable and prudent measure 4:
   a. Prepare and submit a project completion report to NMFS by February 15 of each year that describes the Corps' efforts in carrying out the proposed action as proposed and meeting the terms and conditions issued in this opinion. The project completion report shall include:
      i. Project name and description of work carried out (i.e., entrance channel, navigation channels, access channels, etc.)
      ii. NMFS consultation tracking number: WCRO-2021-00418
      iii. Project manager name and contact information
      iv. Dredge type, i.e., hopper, pipeline, or mechanical
      v. Start and end date of dredging
      vi. Turbidity monitoring log
      vii. Explanation of work stoppages due to weather, equipment failure, etc.
      viii. Any updated sediment analysis plans and appropriate technical memorandums prepared as described in RSET (2016)
      ix. Notification and description of any instance where dredging resulted in exceedance of proposed depths or where dredging occurred outside the authorized channels or turning basins
      x. Notification and description of any instance where the dredge dragheads and/or cutterheads exceed 3 feet above the bottom of the channel with the dredge pumps running more tthan three times per 8 hours of dredging at the Yaquina Bay, Siuslaw River, Umpqua River, Coos River, and Rogue River projects
      xi. Volumes of dredged materials for each project estuary broken down by location (i.e., entrance channels, navigation channels, boat basin access channels, etc.)
      xii. The locations where disposal of dredged material occurred for each project estuary and the number of loads and volume of material that was disposed at each location
      xiii. Number of OC coho salmon captured and killed during fish salvage at Depoe Bay sediment check dam when dredged

b. Schedule an annual coordination meeting with NMFS before March 31 to brief NMFS on the previous and upcoming dredging seasons, final SEF reports, and anything that will improve conservation under this opinion, or make the program more efficient or more accountable.

c. Submit reports with a cover letter to the email projectreports.wcr@noaa.gov and send a copy to jeff.young@noaa.gov. The cover letter recipient address should be as follows

Dr. Kim Kratz, PhD
Attn: WCRO-2021-00418
Assistant Regional Administrator
National Marine Fisheries Service
1201 NE Lloyd Blvd, Suite 1100
Portland, Oregon 97232-1274

2.10. Conservation Recommendations

Section 7(a)(1) of the ESA directs Federal agencies to use their authorities to further the purposes of the ESA by carrying out conservation programs for the benefit of the threatened and endangered species. Specifically, conservation recommendations are suggestions regarding discretionary measures to minimize or avoid adverse effects of a proposed action on listed species or critical habitat or regarding the development of information (50 CFR 402.02).

1. The Corps should use any logs, rootwads, or other woody debris found during dredging for restoration projects in the watershed in which dredging occurred.
2. The Corps should work with NMFS to continue to refine the methodology to evaluate the proposed action's effects on ESA-listed species and determine if there are alternative extents of take indicators that would be better for tracking incidental take associated with the proposed action.
3. The Corps should collaborate with NMFS and ODFW to investigate the distribution and abundance of eulachon and explore funding opportunities for studying eulachon in the project estuaries.
4. The Corps should record observations made of marine mammals or turtles during dredging, transit to disposal sites, and disposal of dredged materials including the following information:
   a. Species observed, if possible, otherwise identification of mammal or turtle
   b. Time and date of observation
   c. Location of observation
   d. Name and contact information of observer
   e. A photo, if possible
5. The Corps should continue to develop and/or implement an eelgrass conservation strategy to conserve eelgrass habitat that may be adversely affected through implementation of their maintenance dredging program at the Oregon Coastal Projects. Report annually regarding the status of this action.
6. To minimize or eliminate the need for dredging in Port Orford, the Corps should seek options for the protection of Port Orford that allows for a return of the area to a natural

deep water port and if not feasible, another least environmentally damaging practicable alternative. Report annually regarding the status of this action.

7. An early detection/emergency response plan should be developed by December 2021 to address rapid detection and response to invasive species. Actions to address detection and removal of invasive species should be incorporated into dredging contracts and implemented in the Corps dredging program. (An example of a potential action: inspect dredges for invasive species (e.g. Caulerpa spp.) prior to moving from one location to another to minimize transportation of invasive species along the coast.) Meet with NOAA-Fisheries by February 2022 to review the plan.

2.11. Reinitiation of Consultation

This concludes formal consultation for the Corps Operation and Maintenance Dredging of the Oregon Coastal Projects.

As 50 CFR 402.16 states, reinitiation of consultation is required and shall be requested by the Federal agency or by the Service where discretionary Federal agency involvement or control over the action has been retained or is authorized by law and if: (1) The amount or extent of incidental taking specified in the ITS is exceeded, (2) new information reveals effects of the agency action that may affect listed species or critical habitat in a manner or to an extent not considered in this opinion, (3) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in the biological opinion, or (4) a new species is listed or critical habitat designated that may be affected by the action.

2.12. "Not Likely to Adversely Affect" Determinations

This determination for eulachon, southern resident killer whales, humpback whales, blue whales, fin whales, sei whales, sperm whales, green sea turtles, leatherback sea turtles, olive ridley sea turtles, loggerhead sea turtles, proposed southern resident killer whale critical habitat, proposed humpback whale critical habitat, and leatherback sea turtle critical habitat was prepared by us pursuant to section 7(a)(2) of the ESA, implementing regulations at 50 CFR 402 and agency guidance for preparation of letters of concurrence.

The applicable standard to find that a proposed action is not likely to adversely affect listed species or critical habitat is that all of the effects of the action are expected to be discountable, insignificant, or completely beneficial. Discountable effects are those extremely unlikely to occur. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs or where alteration of any PBFs of critical habitat reduces those features' ability to support listed species' conservation needs in the action area. Beneficial effects are contemporaneous positive effects without any adverse effect on the listed species or critical habitat. In terms of critical habitat, completely beneficial effects are positive only: an action cannot be deemed wholly beneficial if it has any adverse effect on critical habitat.

The proposed action and the action area for this consultation are described in the Introduction to this document (Sections 1.3 and 1.4).

2.12.1 Eulachon

Eulachon use coastal estuaries and the first few miles of river mainstems. The adults typically return to the Umpqua between January and March.[12] Evidence suggests that adults may return as early as December (WDFW and ODFW 2001) or as late as May (WDFW and ODFW 2001) to spawn on the Columbia River. The eggs hatch within 20–40 days and larvae immediately wash downstream to estuarine and ocean areas. Larval, juvenile, and adult eulachon life stages use the rivers for spawning, incubation, growth, maturation, and migration.

Observation of eulachon in the project estuaries has occurred historically. Eulachon have been observed in the Umpqua River (OFC 1970; Johnson *et al.* 1986; Williams 2009) and the Umpqua River is known to have once supported an extensive recreational fishery for eulachon from 1969 to 1982 (Gustafson *et al*. 2010). Recently, in Coos Bay a pre-spawn female was collected in a screw trap being operated in Winchester Creek, a tributary of South Slough within Coos Bay, on March 3, 2015. Eulachon are rare in the Coquille (Monaco *et al*. 1990), with most recent observations occurring in the last few years by the ODFW.[13] While no direct observations have occurred, eulachon are thought to have also occurred in the Chetco, Rogue, Siuslaw, and Yaquina rivers (Willson *et al.* 2006) in the project area. There is no record or mention of eulachon occurring in Tillamook or Depoe Bays. Only the Umpqua is known to have supported a consistent run of eulachon; however the last recorded observation of eulachon in the Umpqua was in June 2003 (Williams 2009). In all other project estuaries, eulachon are considered rare with infrequent occurrence, if at all. Only the Umpqua River is designated critical habitat for eulachon up to Mill Creek.

The effect of dredging or disposal on larval eulachon is only significant when larval eulachon are actively migrating through the affected area. Since June 2003, eulachon have not been observed in the Umpqua River, although a direct and focused effort to capture migrating adult or larval eulachon has not been undertaken. Nonetheless, the lack of observation does not eliminate the possibility of the presence of migrating eulachon in any year since they were last observed. The recent observations of eulachon in the Coquille River suggest similar conclusions as that for the Umpqua River. With this in mind, we assume that eulachon presence in the Umpqua River and Coquille River is rare and infrequent with small numbers of migrating fish.

Potential overlap of dredging and in-river disposal and typical adult and larval eulachon outmigration periods will occur at the entrance channel for a maximum of only 4 days, in April or May each year. Given the likely presence of only a small number of eulachon that occur on a rare and infrequent basis, and that dredging will only occur for up to 4 days during a 2 month time span (April and May), the probability of exposure of adult or larval eulachon to dredging or disposal of dredged material in the Umpqua River is unlikely. In the Coquille River, dredging occurs at the entrance channel annually between June 15 and October 31. Dredging in the boat

[12] Gustafson *et al.* (2010) discussed newspaper clippings from 1969 to 1982 reporting on the first of entry eulachon in the Umpqua River relative to the recreational sport fishery. Using these we determined the window of first entry of adult eulachon to be January to March. While not ideal, this represents the best information available to determine adult spawning migration timing in the Umpqua River and possibly other Oregon Coast Pacific Ocean tributaries where eulachon are thought to occur on a rare and infrequent basis.

[13] Email from Gary Vonderohe, Oregon Department of Fish and Wildlife, to Jim Muck (NMFS) (June 30, 2016) describing recent observations of Eulachon in the Coquille River Estuary.

basin may occur between July 1 and November 30 every 5 to 10 years. These dredging periods are outside of the typical eulachon migration period. Therefore the limited overlap of project work and migration indicates that the effects of the proposed on migration as a PBF is insignificant in the Umpqua, and in the remainder of the action area effects to this PBF are discountable.

For effects of ocean disposal, eulachon are generally distributed offshore and are not considered common in the nearshore environment of the Pacific Ocean[14] where the ODMDS's are located. There is no supporting information to show presence within a few miles of the shore. The ODMDS's are located within a few miles of the shore with depths ranging from -45 to -205 feet deep. The most likely scenario where exposure of eulachon to ocean disposal of dredged material would occur would be when adults are migrating to spawning habitats or larval eulachon are outmigrating. Based on the migration timing of adult migration into the project estuaries the potential exposure to dredged material disposal would occur in the ODMDS's associated with project estuaries where early dredging occurs including Yaquina Bay (6 days in April or May), Umpqua River (4 days in April or May), and Coos Bay (up to 20 days in April or May for entrance channel, navigation channel, and Charleston access channel). Based on the timing of first entry of adult eulachon in the Umpqua River estuary, most adult eulachon would migrate through the ODMDS's before dredged material disposal would occur in April or May. It is possible that a small number of adult eulachon could remain in the nearshore areas waiting to enter the estuary, but they would be concentrated at the mouths of the rivers and not near the ODMDS's. Therefore, it is unlikely that exposure of adult eulachon to dredged material disposal would occur and thus the effects of the proposed action on adult eulachon are discountable.

Larval eulachon, when hatched are distributed by river and ocean currents grow to juvenile size (30 to 100 millimeters) over a period of 3 to 4 months after hatch (McCarter and Hay 1999, 2003). Information on juvenile marine distribution is limited, owing to these fish being too small to occur in most fisheries and too large to occur in ichthyoplankton surveys (Hay and McCarter 2000). However, Hay and McCarter (2000) reported that juveniles disperse to open, marine waters within the first year of life and perhaps within the first few months. Given the timing of outmigration of larval eulachon, there is potential overlap with ocean disposal; however the probability of exposure of larval or juvenile eulachon to dredged material is discountable because eulachon occur in the Oregon coastal tributaries on a rare and infrequent basis in small numbers, the presence of larval eulachon in the disposal sites will be transitory and they will not be in the disposal sites for a significant period of time, juvenile eulachon will quickly move into open marine waters and deeper depths than those at the disposal sites, and disposal will occur periodically across the coastal marine action area not occurring in all sites at one time. Therefore, because the effects of disposal are discountable, the proposed action is not likely to adversely affect larval and juvenile eulachon.

Because the proposed action's effects are insignificant or discountable to species, we concur with the Corps that the proposed action is not likely to adversely affect the eulachon or their designated critical habitat.

[14] Personal communication between Rob Anderson (NMFS) and Jeff Young (NMFS) discussing marine distribution, life history, and migration timing of eulachon in the Pacific Ocean and project estuaries relative to dredging and ocean disposal associated with this proposed action (November 16, 2015).

2.12.2 Marine Mammals

Marine mammals potentially affected by the proposed action (Table 25) include Southern Resident (SR) killer whales, humpback whales (Mexican and Central American DPSs), blue whales, sei whales, and sperm whales. The Corps did not request consultation for Western North Pacific gray whales, but given their potential to be in the action area, we included them in our analysis.

Table 25. Species of marine mammals affected by the proposed action and summaries of their occurrence in the action area.

Species	Occurrence action area
Southern Resident killer whales	The SR killer whales are primarily found in the inland and coastal waters of Washington from April to October. In the winter and early spring, SR killer whales move into coastal waters and have occurred in Oregon waters with observations extending as far south as Monterey Bay in California and as far north as southeast Alaska (NMFS 2008). While these are seasonal patterns, SR killer whales have the potential to occur in the project vicinity throughout the year.
Humpback whales (Mexican and Central American DPSs)	Humpback whales off the coast of California/Oregon/Washington are primarily from the non-listed Hawaii distinct population segment (DPS) and the threatened Mexico DPS, with a very small proportion from the endangered Central America DPS (Wade *et al*. 2016). The California/Oregon/Washington Stock is defined to include humpback whales that feed off the west coast of the United States. Two feeding groups are identified, California/Oregon and Washington/southern British Columbia.
Blue whales	Occasionally observed off Oregon, blue whale distribution and abundance of the eastern North Pacific (ENP) stock appears to be greater from central to Southern California and primarily distributed offshore out to the exclusive economic zone (EEZ) (Carretta *et al.* 2014). Although there is potential for blue whales to occur along the Oregon Coast, available data indicate that occurrence is likely to be rare in the action area.
Sei whales	Sei whales have a global distribution and occur in the North Atlantic Ocean, North Pacific Ocean, and Southern Hemisphere (NMFS 2011a). The species is cosmopolitan, but with a generally anti-tropical distribution centered in the temperate zones. Sei whales are distributed far out to sea in temperate regions of the world and do not appear to be associated with coastal features (Carretta *et al.* 2013).
Sperm whales	Sperm whales. Sperm whales of the California/Oregon/Washington stock were occasionally observed in Oregon waters with most observations occurring well offshore (Carretta *et al.* 2013). Sperm whales are seen off Washington and Oregon in every season except winter (Green *et al*. 1992).
Fin whales	Observations of the California/Oregon/Washington stock of fin whales off of Oregon were common with aggregations of fin whales observed off of Oregon in the summer (Carretta *et al.* 2014). Additionally, acoustic signals from fin whales are detected year around in northern California, Oregon, and Washington, with a concentration of vocal activity between September and February. They are well distributed across the EEZ (Carretta *et al.* 2014). Although there is potential for fin whales to occur along the Oregon Coast, available data indicate that occurrence is likely to be rare in the action area.

Blue, sei, fin, and sperm whales are not generally distributed nearshore, and their presence in the action area is unlikely. Humpback whales and Southern Resident killer whales are more likely to occur nearer to the shore, but their presence in the action area will be likely infrequent and transitory. The effects of the proposed action include changes to water quality associated with suspended sediment and contaminants and potential vessel interactions during transit to ODMDSs. While there is potential for individuals of these whale species to be exposed to the effects of the proposed action, the rare, infrequent, and transitory nature of their exposure results in a low probability of exposure.

For Southern Resident killer whales, there are only two confirmed cases of southern resident killer whale injuries and deaths due to boat strikes since 2005 (Carretta *et al.* 2019). There was documentation of a whale-boat collision in Haro Strait in 2005 which resulted in a minor injury to a whale. In 2006, whale L98 was killed during a vessel interaction. It is important to note that L98 had become habituated to regularly interacting with vessels during its isolation in Nootka Sound. Both of these collisions were from small vessels. There are two other cases that may or may not be caused by boat strike, but for purposes of this analysis, we will assume they are. In 2012, a moderately decomposed juvenile female (L-112) was found dead near Long Beach, WA. A full necropsy determined the cause of death was blunt force trauma to the head; however, the source of the trauma could not be established (Carretta *et al.* 2019). Similarly, in 2016, a young adult male (J34) was found dead in the northern Georgia Strait. His injuries were consistent with those incurred during a vessel strike, though a final determination has not been made. The annual level of human-caused mortality for this stock from 2007 to 2011 is zero animals per year (Carretta *et al.* 2013).

Although the range of southern resident killer whale overlaps with the action area, few sightings of them occur of the coast of Oregon. From 1982-2016, of the 49 confirmed sightings of southern resident killer whales in coastal waters off the western U.S., only eight occurred off Oregon (NMFS 2019). No documented southern resident killer whale deaths or strandings have occurred near the action area. It is unlikely that interactions between dredge vessels and southern resident killer whales will occur because of the low presence of killer whales in the action area, the lack of interactions with large ships through reporting or the stranding network (none near the action area), and the dredge vessels are slow moving, follow a predictable course, do not target marine mammal, and should be easily detected and avoided by marine mammals. Thus, potential effects from vessel interactions on southern resident killer whales are therefore discountable.

For Blue, sei, fin, humpback, and sperm whales the probability of vessel interactions is unlikely because their occurrence off the Oregon Coast and in the action area is rare. Additionally, the vessels are slow moving, follow a predictable course, do not target marine mammals, and should be easily detected and avoided by marine mammals. Based on this discussion, the probability of vessel interactions combined with the probability of whale occurrence in the action area are low enough that vessel interactions are discountable.

2.12.3 Marine Turtles

Green sea turtles use open ocean convergence zones and coastal areas for benthic feeding of macroalgae and sea grasses. There are no known resting areas along the U.S. West Coast. In the eastern North Pacific, green sea turtles commonly occur south of Oregon, but have been sighted as far north as Alaska (NMFS and USFWS 1998a). Stranding reports indicate that the green sea turtle appears to be a resident in waters off San Diego Bay, California (NMFS and USFWS 1998a) and in the San Gabriel River and surrounding waters in Orange and Los Angeles counties, California. Although there is potential for green sea turtles to occur along the

Washington and Oregon coasts, available data indicate that occurrence is likely to be rare in the action area.

Loggerhead sea turtles inhabit continental shelves, bays, estuaries, and lagoons in the Atlantic, Pacific, and Indian Oceans (NMFS and USFWS 1998b). On the U.S. West Coast, most sightings of loggerhead turtles are of juveniles. Most sightings are off California; however, there are also a few sighting records from Washington and Alaska (Bane 1992). There are no known resting areas along the U.S. West Coast. Although there is potential for loggerhead sea turtles to occur along the Washington and Oregon coasts, available data indicate that occurrence is likely to be rare in the action area.

Olive ridley sea turtles have a mostly pelagic distribution, but they have been observed to inhabit coastal areas. They are the most common and widespread sea turtle in the eastern Pacific. On the U.S. West Coast, they primarily occur off California, although stranding records indicate olive ridleys have been killed by gillnets and boat collisions in Oregon and Washington waters (NMFS and USFWS 1998c). In the eastern Pacific, nesting largely occurs off southern Mexico and northern Costa Rica (NMFS and USFWS 1998c). Although there is potential for olive ridley sea turtles to occur along the Oregon coast, available data indicate that occurrence is likely to be rare in the action area.

We do not have reliable abundance estimates for the foraging population of leatherback sea turtles in Oregon and Washington waters. Greatest densities are found off central California and in waters off the Columbia River (Benson *et al.* 2011). These areas have oceanographic retention areas or upwelling shadows that create favorable habitat for leatherback sea turtle prey, mainly cnidarians (medusae, siphonophores) and tunicates (salps, pyrosomas) (NMFS and USFWS 1998d). The critical habitat analytical review team (CHART) identified the Columbia River plume (46th parallel) and the Heceta Bank (44th parallel) as two important foraging areas off the Oregon Coast (NMFS 2012). Suchman and Brodeur (2005) indicated favorable habitat for leatherbacks at Heceta Bank and Cape Blanco. These areas are productive due to conditions conducive to growth of gelatinous prey (Benson *et al.* 2011). Aerial surveys conducted by NMFS and results of experimental driftnet fishery interactions off Oregon and Washington between 2003 and 2011 resulted in very few sightings of leatherback sea turtles. All but one sighting were close to or above the 45th parallel (NMFS unpublished data). The action area likely acts as a transitory area where leatherback turtles migrate between forage areas, thus their presence in the action may occur, but they will not spend a significant amount of time there.

Based on the information above there is low probability that marine turtles would be exposed to the effects action because of their rare occurrence and transitory use of the action area. In the event an individual were in the action area they will not spend a significant amount of time in the action area that would elicit an adverse individual response. Additionally, the dredging vessels are slow moving, follow a predictable course, do not target marine turtles, and should be easily detected and avoided by marine turtles. Therefore, the proposed action is not likely to adversely affect marine turtles in the action area.

2.12.4 Critical Habitat

The action area is proposed critical habitat for southern resident killer whales and designated critical habitat for Central American and Mexican DPS humpback whales and eulachon.

Leatherback turtles

The proposed action may affect critical habitat for leatherback sea turtles. Based on the natural history of the species and their habitat needs, NMFS designated critical habitat based on occurrence of prey species (jellyfish) of sufficient condition, distribution, diversity, and abundance and density necessary to support individual as well as population growth, reproduction, and development. Leatherback turtle prey will be affected by disposal of dredged material at the ODMDSs. However, the effects of disposal on prey organisms is insignificant because prey is widely distributed throughout the action area, the areas of the disposal sites and areas affected by disposal events are small relative to the amount of foraging area available to leatherback turtles in the action area, and prey organisms are mobile and moving through the disposal sites between disposal events. Because the effects of the proposed action on leatherback turtle designated critical habitat are insignificant, the proposed action is not likely to adversely affect leatherback turtle designated critical habitat.

Humpback whales

The marine action area is proposed critical habitat for humpback whales. The only PBF designated for critical habitat is prey. As described above the proposed action would expose prey to suspended sediments and entrainment from disposed dredged material, which could affect prey resources of humpback whales. However, the effects of the proposed action on abundance of prey resources are reasonably unlikely to be meaningful because the action area consists of such a small portion of rangewide critical habitat designation for humpback whales. Therefore, the proposed action will not reduce the quality and function of the prey PBF for humpback whales.

Proposed critical habitat for SR killer whales

The proposed action may affect forage for SR killer whales by reducing availability of their primary prey, adult Chinook salmon from dredge entrainment or exposure to dredged material disposal at the ODMDSs. The proposed activities are not expected produce a measurable effect on the abundance, distribution, diversity, or productivity of Chinook salmon at either the population or species level. Given the total quantity of prey available to Southern Resident killer whales throughout their range, this reduction in prey is extremely small, and is not anticipated to be different than zero by multiple decimal places (based on NMFS previous analyses of the effects of salmon harvest on Southern Resident killer whales, e.g. NMFS No. WCR-2017-7164). Because the reduction is so small, there is also a low probability that any juvenile Chinook salmon killed by the proposed activities would have later (in 3-5 year timeframe) been intercepted by the killer whales across their vast range in the absence of the proposed activities. Therefore, the anticipated reduction of salmonids associated with the proposed action would result in an insignificant reduction in adult equivalent prey resources for Southern Resident killer whales and an insignificant effect on proposed southern resident killer whale critical habitat.

Eulachon

Only the Umpqua River is critical habitat for eulachon. As described in the opinion, the effects to forage abundance and water quality were short-term and localized and determined to not be minor or meaningful. Similarly, for eulachon critical habitat dredging and disposal in the project estuaries are minor and not meaningful to the food and water quality PBFs because the effects will be short-term and localized to the areas of dredging and disposal, adult and larval eulachon presence during dredging will be transitory and short-term, adult eulachon do not feed once they enter the estuary, and larval eulachon would be feeding on their yolk-sac during outmigration. Therefore, the effects of the proposed action on food and water quality PBFs are insignificant.

The effect of dredging or disposal on the migration corridor as a PBF is only significant when larval eulachon are actively migrating through the affected area. Since June 2003, eulachon have not been observed in the Umpqua River, although a direct and focused effort to capture migrating adult or larval eulachon has not been undertaken. Nonetheless, the lack of observation does not eliminate the possibility of the presence of migrating eulachon in any year since they were last observed. The recent observations of eulachon in the Coquille River suggest similar conclusions as that for the Umpqua River. With this in mind, we assume that eulachon presence in the Umpqua River and Coquille River is rare and infrequent with small numbers of migrating fish.

Potential overlap of dredging and in-river disposal and typical adult and larval eulachon outmigration periods will occur at the entrance channel for a maximum of only 4 days, in April or May each year. Given the likely presence of only a small number of eulachon that occur on a rare and infrequent basis, and that dredging will only occur for up to 4 days during a 2 month time span (April and May), the probability of overlap of migrating adult or larval eulachon to dredging or disposal of dredged material in the Umpqua River is unlikely. In the Coquille River, dredging occurs at the entrance channel annually between June 15 and October 31. Dredging in the boat basin may occur between July 1 and November 30 every 5 to 10 years. These dredging periods are outside of the typical eulachon migration period. We similarly find the probability of overlap of migrating adult or larval eulachon to dredging and disposal of dredged material in the Coquille River is unlikely. A few days of proposed dredging (7 days channel and 14 days boat basin), the later season summer and fall dredging, and rare occurrence of eulachon in the Coquille River, support this conclusion. Therefore the limited overlap of project work and migration indicates that the effects of the proposed action on migration as a PBF is insignificant in the Umpqua, and in the remainder of the action area effects to this PBF are discountable.

2.12.5 Conclusion

Based on this analysis, we concur with the Corps determination that the proposed action is not likely to adversely affect eulachon, marine mammals, or marine turtles, nor any designated critical habitats identified here in Section 2.11.

3. MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT ESSENTIAL FISH HABITAT RESPONSE

Section 305(b) of the MSA directs Federal agencies to consult with NMFS on all actions or proposed actions that may adversely affect EFH. Under the MSA, this consultation is intended to promote the conservation of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA , EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the physical, biological, and chemical properties that are used by fish (50 CFR 600.10). Adverse effect means any impact that reduces quality or quantity of EFH, and may include direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat, and other ecosystem components, if such modifications reduce the quality or quantity of EFH. Adverse effects on EFH may result from actions occurring within EFH or outside of it and may include site-specific or EFH-wide impacts, including individual, cumulative, or synergistic consequences of actions (50 CFR 600.810). Section 305(b) of the MSA also requires NMFS to recommend measures that can be taken by the action agency to conserve EFH. Such recommendations may include measures to avoid, minimize, mitigate, or otherwise offset the adverse effects of the action on EFH [CFR 600.905(b)]

This analysis is based, in part, on the EFH assessment provided by the Corps and descriptions of EFH for Pacific Coast salmon (PFMC 2014), Pacific Coast groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998) contained in the fishery management plans developed by the PFMC and approved by the Secretary of Commerce.

3.1. Essential Fish Habitat Affected by the Project

The PFMC described and identified EFH for Pacific Coast salmon (PFMC 2014), Pacific Coast groundfish (PFMC 2005), and coastal pelagic species (PFMC 1998). The proposed action and action area for this consultation are described in the Introduction to this document (Section 1). The action area includes areas designated as EFH for various life-history stages of Pacific coast groundfish, Pacific salmon, and coastal pelagic species (Table 26). In addition, the following habitat area of particular concern is present in the action area: estuarine.

Table 26. Species with designated EFH found in waters of Oregon and Washington.

Groundfish Species	
Leopard shark (*Triakis semifasciata*)	Chilipepper (*S. goodei*)
Soupfin shark (*Galeorhinus zyopterus*)	China rockfish (*S. nebulosus*)
Spiny dogfish (*Squalus acanthias*)	Copper rockfish (*S. caurinus*)
Big skate (*Raja binoculata*)	Darkblotched rockfish (*S. crameri*)
California skate (*R. inornata*)	Grass rockfish (*S. rastrelliger*)
Longnose skate (*R. rhina*)	Rougheye rockfish (*S. aleutianus*)
Ratfish (*Hydrolagus colliei*)	Sharpchin rockfish (*S. zacentrus*)
Pacific rattail (*Coryphaenoides acrolepsis*)	Shortbelly rockfish (*S. jordani*)
Lingcod (*Ophiodon elongatus*)	Shortraker rockfish (*S. borealis*)
Cabezon (*Scorpaenichthys marmoratus*)	Silvergray rockfish (*S. brevispinus*)
Kelp greenling (*Hexagrammos decagrammus*)	Speckled rockfish (*S. ovalis*)
Pacific cod (*Gadus macrocephalus*)	Splitnose rockfish (*S. diploproa*)
Pacific whiting (Hake) (*Merluccius productus*)	Stripetail rockfish (*S. saxicola*)
Sablefish (*Anoplopoma fimbria*)	Tiger rockfish (*S. nigrocinctus*)
Aurora rockfish (*Sebastes aurora*)	Vermillion rockfish (*S. miniatus*)
Bank Rockfish (*S. rufus*)	Widow Rockfish (*S. entomelas*)
Black rockfish (*S. melanops*)	Yelloweye rockfish (*S. ruberrimus*)
Blackgill rockfish (*S. melanostomus*)	Yellowmouth rockfish (*S. reedi*)
Greenspotted rockfish (*S. chlorostictus*)	Yellowtail rockfish (*S. flavidus*)
Greenstriped rockfish (*S. elongatus*)	Arrowtooth flounder (*Atheresthes stomias*)
Longspine thornyhead (*Sebastolobus altivelis*)	Butter sole (*Isopsetta isolepsis*)
Shortspine thornyhead (*Sebastolobus alascanus*)	Curlfin sole (*Pleuronichthys decurrens*)
Pacific Ocean perch (*S. alutus*)	Dover sole (*Microstomus pacificus*)
Quillback rockfish (*S. maliger*)	English sole (*Parophrys vetulus*)
Redbanded rockfish (*S. babcocki*)	Flathead sole (*Hippoglossoides elassodon*)
Redstripe rockfish (*S. proriger*)	Pacific sanddab (*Citharichthys sordidus*)
Rosethorn rockfish (*S . helvomaculatus*)	Petrale sole (*Eopsetta jordani*)
Rosy rockfish (*S. rosaceus*)	Rex sole (*Glyptocephalus zachirus*)
Blue rockfish (*S. mystinus*)	Rock sole (*Lepidopsetta bilineata*)
Bocaccio (*S. paucispinis*)	Sand sole (*Psettichthys melanostictus*)
Brown rockfish (*S. auriculatus*)	Starry flounder (*Platyichthys stellatus*)
Canary rockfish (*S. pinniger*)	
Coastal Pelagic Species	
Northern anchovy (*Engraulis mordax*)	Jack mackerel (*Trachurus symmetricus*)
Pacific sardine (*Sardinops sagax*)	Market squid (*Loligo opalescens*)
Pacific mackerel (*Scomber japonicus*)	
Pacific Salmon	
Coho salmon (*O. kisutch*)	Chinook salmon (*O. tshawytscha*)

3.2. Adverse Effects on Essential Fish Habitat

The ESA portion of this document (Section 2.5.1) describes the adverse effects of this proposed action on ESA-listed species critical habitat. The ESA analysis of effects is relevant to Pacific Coast groundfish, coastal pelagic species, and Pacific salmon EFH. Based on the ESA analysis of effects, the Corps' project will cause adverse effects to EFH for Pacific Coast groundfish, coastal pelagic species, and Pacific salmon, including direct or indirect physical, chemical, or biological alteration of the waters or substrate and loss of (or injury to) benthic organisms, prey species and their habitat. Therefore, we agree with the Corps effects determination that the proposed action would adversely affect EFH for Pacific Coast groundfish, coastal pelagic species, and Pacific salmon.

3.3. Essential Fish Habitat Conservation Recommendations

NMFS determined that the following conservation recommendations are necessary to avoid, minimize, mitigate, or otherwise offset the impact of the proposed action on EFH. Fully implementing the EFH conservation recommendations described below would protect, by avoiding or minimizing the adverse effects to water, substrate, and prey species as described in Section 3.2, in approximately 9,481 acres of designated EFH for Pacific Coast salmon, Pacific Coast groundfish, and coastal pelagic species.

1. To reduced adverse alteration of water, substrate, and forage abundance. Minimize adverse effects to forage abundance and forage species habitat by:
    a. Confining the dredge prism to the minimum area necessary to achieve project goals and ensuring the resulting depth of the entrance channel will not be deeper than the authorized project depth including advanced maintenance and overdepth.
    b. Keeping dredge dragheads and/or cutterheads below three feet above the bottom of the channel with the dredge pumps running more than three times per eight hours of dredging at the Yaquina Bay, Siuslaw River, Umpqua River, Coos Bay, and Rogue River Projects.
    c. Not disposing of dredged material at the Umpqua River and Coos Bay in-river disposal sites during the months of April through June.
    d. Dredging only the minimum amount of materials necessary and minimizing the number of disposal loads while still achieving project goals.
    e. Monitoring the number of disposal loads and volume of dredged material disposed of at the in-river disposal sites and ODMDS's. Report them annually to NMFS.

2. To reduce adverse alteration of water quality. Complete turbidity monitoring when dredging in areas of fine-grained sediments (equal to, or greater than, 20% silts/clays) as follows:
    a. For fine-grained sediments conduct turbidity measurements every four hours using an appropriate and regularly calibrated turbidimeter to quantify change as nephlometic turbidity units (NTUs).
    b. In areas with coarse-grained sediments, use visual observation to determine if there is significantly detectable change.
    c. Conduct baseline and compliance turbidity monitoring and compare results of baseline and compliance samples to determine whether turbidity increased below the work area. Conduct turbidity monitoring as follows:
        i. Select a baseline site at a relatively undisturbed area approximately 200 feet upcurrent from each work area and make a surface observation (for visual monitoring) or take a sample at approximately mid-depth (when using a turbidimeter) and within any visible plume to determine background turbidity. Record the location of the baseline site, the date, time of day, tidal stage of the turbidity sample, and the turbidity before

monitoring downstream. Note any other relevant sampling conditions (*e.g.*, weather, river stage, upstream activity, onsite activity).

ii. Select a compliance site approximately 200 feet downcurrent of the designated area and make a surface observation (for visual monitoring) or take a sample at approximately mid-depth (when using a turbidimeter) and within any visible plume to compare with the baseline. Record the location of the compliance site, the date, time, and tidal stage of the turbidity sample, and the turbidity. Note any other relevant sampling conditions.

iii. If turbidity increased to any visible extent (plainly apparent changes in water color or clarity), continue to monitor every two hours and carry out BMPs or other corrective action as necessary to reduce turbidity, including any work necessary to repair, replace or reinforce sediment controls. BMPs to minimize sediment disturbance and distribution through the water column include, but are not limited to, the following:

d. Sequence or phase work activities to minimize the extent and duration of in-water disturbances.
e. Employ an experienced equipment operator.
f. Use bucket control techniques, such as:
    i. Do not overfill the bucket.
    ii. Close the bucket as slowly as possible on the bottom.
    iii. Pause before hoisting the bucket off of the bottom to allow any overage to settle near the bottom.
    iv. Hoist load very slowly.
    v. If dewatering is permissible, pause bucket at water surface to minimize distance of discharge.
    vi. "Slam" open the bucket after material is dumped on a barge to dislodge any additional material that is potentially clinging to the bucket.
    vii. Ensure that all material has dumped into the barge from the bucket before returning for another bite.
    viii. Do not dump partial or full buckets of material back into the wetted stream.
    ix. Vary the volume, speed, or both of digging passes to minimize siltation to the maximum extent practicable.
g. If turbidity reaches any of the following thresholds, cease work for the remainder of that 24-hour period:
    i. 30 NTUs above background for two consecutive two-hour samples for fine-grained sediments;
    ii. 50 NTUs or more above background for any sample, or
    iii. for coarse-grained sediments, continues to exhibit plainly apparent changes in water color or clarity (discernable by visual observation) after the application of corrective measures.
    iv. If any dredging operations in any of the locations exceed two cease-work events during a single dredging season due to turbidity, the Corps must provide additional BMPs, change operations, or both in order to reduce sediment disturbances and distribution.

v. Prepare and submit a summary of the turbidity monitoring, including a photograph of the baseline and compliance sites; a copy of turbidity measurements or observations with the date and time that each was taken; other relevant sampling conditions; and description of any sediment control failure, sediment release, correction efforts, BMPs attempted, and any time work was stopped or restarted.

3. The Corps should use any logs, rootwads, or other woody debris found during dredging for restoration projects in the watershed in which dredging occurred.

4. The Corps should continue to develop and/or implement an eelgrass conservation strategy to conserve eelgrass habitat that may be adversely affected through implementation of their maintenance dredging program at the Oregon Coastal Projects. Progress and updates on this strategy should be reported annually.

5. Monitoring. Ensure completion of a monitoring and reporting program to confirm the proposed action is meeting the objective of limiting adverse effects to EFH. Include information elements as stated in ESA term and condition #3 in the accompanying opinion.

6. The Corps should create a beneficial use program along the Oregon Coast with local partners and others to utilize gravel and minimize amount being transported to the ocean disposal site. Report annually the status of this program.

7. To minimize or eliminate the need for dredging, the Corps should seek options for the protection of Port Orford that allows for a return of the area to a natural deep water port and if not feasible, another least environmentally damaging practicable alternative. Report annually regarding the status.

8. An early detection/emergency response plan should be developed by December 2021 to address rapid detection and response to invasive species. Actions to address detection and removal of invasive species should be incorporated into dredging contracts and implemented in the Corps dredging program. (An example of a potential action: inspect dredges for invasive species (e.g. Caulerpa spp.) prior to moving from one location to another to minimize transportation of invasive species along the coast.) Meet with NOAA-Fisheries by February 2022 to review the plan.

3.4. Statutory Response Requirement

As required by section 305(b)(4)(B) of the MSA, the Corps must provide a detailed response in writing to NMFS within 30 days after receiving an EFH Conservation Recommendation. Such a response must be provided at least 10 days prior to final approval of the action if the response is inconsistent with any of NMFS' EFH Conservation Recommendations unless NMFS and the Federal agency have agreed to use alternative time frames for the Federal agency response. The response must include a description of the measures proposed by the agency for avoiding, minimizing, mitigating, or otherwise offsetting the impact of the activity on EFH. In the case of a response that is inconsistent with the Conservation Recommendations, the Federal agency must explain its reasons for not following the recommendations, including the scientific justification for any disagreements with NMFS over the anticipated effects of the action and the measures needed to avoid, minimize, mitigate, or offset such effects (50 CFR 600.920(k)(1)).

In response to increased oversight of overall EFH program effectiveness by the Office of Management and Budget, NMFS established a quarterly reporting requirement to determine how many conservation recommendations are provided as part of each EFH consultation and how many are adopted by the action agency. Therefore, we ask that in your statutory reply to the EFH portion of this consultation, you clearly identify the number of conservation recommendations accepted.

3.5. Supplemental Consultation

The Corps must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH Conservation Recommendations (50 CFR 600.920(l)).

4. FISH AND WILDLIFE COORDINATION ACT

The purpose of the FWCA is to ensure that wildlife conservation receives equal consideration, and is coordinated with other aspects of water resources development (16 USC 661). The FWCA establishes a consultation requirement for Federal agencies that undertake any action to modify any stream or other body of water for any purpose, including navigation and drainage (16 USC 662(a)), regarding the impacts of their actions on fish and wildlife, and measures to mitigate those impacts. Consistent with this consultation requirement, NMFS provides recommendations and comments to Federal action agencies for the purpose of conserving fish and wildlife resources, and providing equal consideration for these resources. NMFS' recommendations are provided to conserve wildlife resources by preventing loss of and damage to such resources. The FWCA allows the opportunity to provide recommendations for the conservation of all species and habitats within NMFS' authority, not just those currently managed under the ESA and MSA.

The following recommendations apply to the proposed action:

1. An early detection/emergency response plan should be developed by December 2021 to address rapid detection and response to invasive species. Actions to address detection and removal of invasive species should be incorporated into dredging contracts and implemented in the Corps dredging program. (An example of a potential action: inspect dredges for invasive species (e.g. Caulerpa spp.) prior to moving from one location to another to minimize transportation of invasive species along the coast.) Meet with NOAA-Fisheries by February 2022 to review the plan.

The action agency must give these recommendations equal consideration with the other aspects of the proposed action so as to meet the purpose of the FWCA.

This concludes the FWCA portion of this consultation.

5. DATA QUALITY ACT DOCUMENTATION AND PRE-DISSEMINATION REVIEW

The Data Quality Act (DQA) specifies three components contributing to the quality of a document. They are utility, integrity, and objectivity. This section of the opinion addresses these DQA components, documents compliance with the DQA, and certifies that this opinion has undergone pre-dissemination review.

Utility

Utility principally refers to ensuring that the information contained in this consultation is helpful, serviceable, and beneficial to the intended users. The intended users of this opinion are Corps. Other interested users could include Corps dredging contractors. Individual copies of this opinion were provided to the Corps. The document will be available within two weeks at the NOAA Library Institutional Repository [https://repository.library.noaa.gov/welcome]. The format and naming adheres to conventional standards for style.

Integrity

This consultation was completed on a computer system managed by NMFS in accordance with relevant information technology security policies and standards set out in Appendix III, 'Security of Automated Information Resources,' Office of Management and Budget Circular A-130; the Computer Security Act; and the Government Information Security Reform Act.

Objectivity

Information Product Category: Natural Resource Plan

Standards: This consultation and supporting documents are clear, concise, complete, and unbiased; and were developed using commonly accepted scientific research methods. They adhere to published standards including the NMFS ESA Consultation Handbook, ESA regulations, 50 CFR 402.01 et seq., and the MSA implementing regulations regarding EFH, 50 CFR 600.

Best Available Information: This consultation and supporting documents use the best available information, as referenced in the References section. The analyses in this opinion and EFH consultation contain more background on information sources and quality.

Referencing: All supporting materials, information, data and analyses are properly referenced, consistent with standard scientific referencing style.

Review Process: This consultation was drafted by NMFS staff with training in ESA and MSA implementation, and reviewed in accordance with West Coast Region ESA quality control and assurance processes.

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7. APPENDICES

7.1 Appendix A

Depoe Bay Maintenance Dredging – Proposed Dewatering

The purpose of this document is to provide the regulatory and permitting guidelines for the Contractor for implementation during the Depoe Bay Maintenance Dredging project. This document will delineate both avoidance and dewatering measures that can be used. However, it will be the responsibility of the Contractor to submit a final dewatering plan that details means and methods for construction in full compliance with the requirements presented in the contract specifications.

In addition to the requirements of this document, Contractor shall also reference the Hazardous Material Management Plan and Emergency Management and Spill Prevention Plan as requirements throughout those plans address work in or around waterways and wetlands. As such, it will be the goal of the Contractor to ensure protection of groundwater during excavations from potential contaminant releases during equipment use and refueling, such as specific spill control and clean up and response measures in the vicinity of excavations.

SEQUENCE OF WORK

1. Isolate the work area.
    a. Cofferdam systems are the most common method for separation in-water construction sites from flowing stream.
    b. Cofferdams may include, but are not limited to; small sandbags, industrial, one cubic yard sandbags, jersey barriers, sheet piles, and proprietary/manufactured devices.
    c. Erosion control will be placed around the Cofferdam structure.
2. Slowly dewater the isolation area.
    a. The work area will be dewatered to allow construction work to occur "in the dry"
    b. The work area water is pumped to a sloped field to allow the water to flow through a vegetated buffer prior to reentering the stream.
3. Conduct electrofishing and seining/netting and relocate fish to an area outside the isolation area
4. If required, provide a fish bypass from South Depoe Creek to the Depoe Boat Basin during construction activities. Construction estimated to be completed in 7 days.

IN-WATER WORK PERIOD (DEWATERING)

Dewatering operations may only occur between July 1st and August 31st.

DEWATERING BEST MANAGEMENT PRACTICES

The following Best Management Practices shall be implemented.

- Excavated material must be placed so that it is isolated from the water edge or wetlands, and not placed where it could re-enter waters of the state uncontrolled.

- Any activity that may disrupt the movement of aquatic life living in the water body, including those species that normally migrate through the area, is prohibited. The Applicant must provide unobstructed fish passage at all times during any authorized activity, unless otherwise approved in the approved application.
- Discharge to waters of the state resulting from dewatering during dredging or release of return water from an upland facility is prohibited except as follows: All water removed with sediment must be contained and disposed of at an appropriately sized and sealed upland facility by evaporation or infiltration.
- **Fish Capture and Release**

a) If practicable, allow listed fish species to migrate out of the work area or remove fish before dewatering; otherwise remove fish from an exclusion area as it is slowly dewatered with methods such as hand or dip-nets, seining, or trapping with minnow traps (or gee-minnow traps).
b) Fish capture will be supervised by a qualified fisheries biologist, with experience in work area isolation and competent to ensure the safe handling of all fish.
c) Conduct fish capture activities during periods of the day with the coolest air and water temperatures possible, normally early in the morning to minimize stress and injury of species present.
d) Monitor the nets frequently enough to ensure they stay secured to the banks and free of organic accumulation.
e) Electrofishing will be used during the coolest time of day, only after other means of fish capture are determined to be not feasible or ineffective.

    i) Do not electrofish when the water appears turbid, *e.g.*, when objects are not visible at depth of 12 inches.

    ii) Do not intentionally contact fish with the anode.

    iii) Follow NMFS (2000) electrofishing guidelines, including use of only direct current (DC) or pulsed direct current within the following ranges:11

        1. If conductivity is less than 100 μs, use 900 to 1100 volts.
        2. If conductivity is between 100 and 300 μs, use 500 to 800 volts.
        3. If conductivity greater than 300 μs, use less than 400 volts.

    iv) Begin electrofishing with a minimum pulse width and recommended voltage, then gradually increase to the point where fish are immobilized.
    v) Immediately discontinue electrofishing if fish are killed or injured, *i.e.*, dark bands visible on the body, spinal deformations, significant descaling, torpid or inability to maintain upright attitude after sufficient recovery time. Recheck machine settings, water temperature and conductivity, and adjust or postpone procedures as necessary to reduce injuries.

f) If buckets are used to transport fish:

    i) Minimize the time fish are in a transport bucket.

ii) Keep buckets in shaded areas or, if no shade is available, covered by a canopy.

iii) Limit the number of fish within a bucket; fish will be of relatively comparable size to minimize predation.

iv) Use aerators or replace the water in the buckets at least every 15 minutes with cold clear water.

v) Release fish in an area upstream with adequate cover and flow refuge

vi) Be careful to avoid mortality counting errors.

(1) Monitor and record fish presence, handling, and injury during all phases of fish capture and submit a fish salvage report (Appendix A, Part 1 with Part 3 completed) to the Corps and the SLOPES mailbox (slopes.nwr@noaa.gov) within 60 days.

- **Fish Passage**

a) Provide fish passage for any adult or juvenile ESA-listed fish likely to be present in the action area during construction, unless passage did not exist before construction or the stream is naturally impassable at the time of construction.
b) After construction, provide fish passage for any adult or juvenile ESA-listed fish that meets NMFS's fish passage criteria (NMFS 2011b) for the life of the action.

- **Fish Screens**

a) Submit to NMFS for review and approval fish screen designs for surface water diverted by gravity or by pumping at a rate that exceeds 3 cubic feet per second (cfs).
b) All other diversions will have a fish screen that meets the following specifications:
   i) An automated cleaning device with a minimum effective surface area of 2.5 square feet per cubic foot per second, and a nominal maximum approach velocity of 0.4 feet per second, or no automated cleaning device, a minimum effective surface area of 1 square foot per cubic foot per second, and a nominal maximum approach rate of 0.2 foot per second; and
   ii) A round or square screen mesh that is no larger than 2.38 millimeters (mm) (0.094") in the narrow dimension, or any other shape that is no larger than 1.75 mm (0.069") in the narrow dimension.
c) Each fish screen will be installed, operated, and maintained according to NMFS's fish screen criteria.

- **Work Area Isolation**

a) Isolate any work area within the wetted channel from the active stream whenever ESA-listed fish are reasonably certain to be present, or if the work area is less than 300 feet upstream from known spawning habitats.
b) Engineering design plans for work area isolation will include all isolation elements and fish release areas.
c) Dewater the shortest linear extent of work area practicable, unless wetted instream work is deemed to be minimally harmful to fish, and is beneficial to other aquatic species.

i) Use a coffer dam and a by-pass culvert or pipe, or a lined, non-erodible diversion ditch to divert flow around the dewatered area. Dissipate flow energy to prevent damage to riparian vegetation or stream channel and provide for safe downstream reentry of fish, preferably into pool habitat with cover.
ii) Where gravity feed is not possible, pump water from the work site to avoid rewatering. Maintain a fish screen on the pump intake to avoid juvenile fish entrainment.
iii) Pump seepage water to a temporary storage and treatment site, or into upland areas, to allow water to percolate through soil or to filter through vegetation before reentering the stream channel with a treatment system comprised of either a hay bale basin or other sediment control device.
iv) Monitor below the construction site to prevent stranding of aquatic organisms.
v) When construction is complete, re-water the construction site slowly to prevent loss of surface flow downstream, and to prevent a sudden increase in stream turbidity.

d) Whenever a pump is used to dewater the isolation area and ESA-listed fish may be present, a fish screen will be used that meets the most current version of NMFS's fish screen criteria (NMFS 2011b). NMFS approval is required for pumping at a rate that exceeds 3 cfs.